THE AMPHIPOD FAMILY OEDICEROTIDAE ON THE PACIFIC COAST OF NORTH AMERICA. I. THE *MONOCULODES* & *SYNCHELIDIUM* GENERIC COMPLEXES: SYSTEMATICS AND DISTRIBUTIONAL ECOLOGY

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ABSTRACT

The gammaridean amphipod crustacean family Oedicerotidae is represented on the Pacific coast of North America by 29 species of the *Monoculodes* generic complex [= *Monoculodes* Stimpson, 1853 (sens. lat.)] and 8 species of the *Synchelidium* generic complex [= *Synchelidium* Sars, 1895 (sens. lat.), and related genera]. The genus *Monoculodes* is here rediagnosed and restricted on the basis of Stimpson's original treatment of the genus and his type species, *M. demissus,* from the North American Atlantic region. The *Monoculodes* complex is subdivided into several natural genera of which the following taxa occur in the study region, from the Bering Sea to northern California: *Monoculodes* Stimpson, 1853, encompassing *M. latimanus* Boeck, 1871; *M. emarginatus* J. L. Barnard, 1962, *M. perditus* J. L. Barnard, 1966; ***M. brevirostris***, new species; *M. castalskii* Gurjanova, 1951; and *M. diamesus* Gurjanova, 1951; ***Deflexilodes***, new genus [Type species - *D. tenuirostratus* (Boeck, 1871)], including ***D. similis***, new species; ***D. enigmaticus***, new species; and *D. tuberculatus* (Boeck, 1871); *Monoculopsis longicornis* Sars, 1895; ***Pacifoculodes***, new genus, including its type species *P. spinipes* (Mills, 1962); ***P. bruneli,*** new species; ***P. barnardi,*** new species; ***P. levingsi***, new species, *P. zernovi* (Gurjanova, 1938); and *P. crassirostris* (Hansen, 1887, fide Gurjanova, 1951.).

The following, mainly extralimital genera of the *Monoculodes* complex are diagnosed, and North Pacific regional species are keyed: ***Ameroculodes***, new genus [(Type species- *A. edwardsi* (Holmes, 1905)]; ***Hartmanodes***, new genus [Type species- *H. hartmanae* (J. L. Barnard, 1962)]; ***Limnoculodes,*** new genus [Type species- *L. limnophilus* (Tattersall, 1922)]; and ***Rostroculodes,*** new genus [Type species - *R. longirostris* (Goes, 1866)]. *Kroyera* Bate, 1857, is revived to encompass the distinctive European Atlantic type species *K. carinata* Bate, 1857.

The *Synchelidium* generic complex is here subdivided into *Synchelidium* Sars, 1895 (sens. str.)[Type species - *S. haplocheles* Grube, 1864]; ***Eochelidium,*** new genus [Type species- *E. lenorostralum* (Hirayama, 1986)]; *Chitinomandibulum* Jo, 1990 [Type species - *C. emargicoxa* Jo, 1990]; and ***Americhelidium***, new genus [Type species - *A. shoemakeri* (Mills,1962)]. The following North American Pacific species of *Americhelidium* are diagnosed: *Americhelidium rectipalmum* (Mills, 1962); *A shoemakeri* (Mills, 1962); ***A. setosum***, new species; ***A. millsi***, new species; ***A. pectinatum***, *new species*; and ***A. variabilum***, new species. *Americhelidium micropleon* (Barnard, 1977) from the eastern North Pacific, and *A. gurjanovae* (Kudrjaschov & Tzvetkova, 1975), and *A. latipalpum* (Hirayama, 1986) from the western North Pacific, are also keyed.

Biogeographically, within the *Monoculodes* generic complex, the eastern and western North Pacific regions contain about equal numbers of species, but of very different generic composition. The *Monoculodes* complex is almost exclusively arctic and arctic-boreal, but a few species of the primitive genus *Monoculodes* Stimpson (sens. str.) are recorded from antiboreal regions. The *Synchelidium* complex is much more diverse in the western North Pacific where it contains 7 species of *Eochelidium,* and representatives of the genera *Chitinomandibulum* Jo, *Perioculodes* Sars, *Pontocrates* Boeck, *Hongkongvena* Hirayama, and *Sinoediceros* Shen. The eastern North Pacific reveals only 8 species, within *Americhelidum* and *Finoculodes* J. L. Barnard.

INTRODUCTION

On the Pacific coast of North America, knowledge of the systematics and distributional ecology of oedicerotid amphipods has been fairly well established for the California region. Studies by the late J. L. Barnard (1961, 1962, 1966, 1967, 1969b, 1971, 1975, 1977, etc.) encompassed several species of *Monoculodes, Bathymedon, Synchelidium* and other genera, especially in the region south of Pt. Conception. From the central region of Washington through British Columbia to southeastern Alaska, the study of Mills (1962) provided detailed systematic knowledge of two species of *Monoculodes,* two of *Synchelidium,* and one of *Westwoodilla.* Previous individual records of *M. zernovi* from Washington State by Weiser (1959), and of M. *carinatus* Bate from Puget Sound by Wailes (1931), may be unverifiable. Staude (1987) rounded out the limited total from the central region with records of two species of *Bathymedon,* both described previously by Barnard from more southerly waters. Records from the Bering Sea-Alaska mainland region are equally sparse, and are represented mainly by *Macheironyx muelleri* Coyle, 1980,and by the amphipod listings of Slattery (pers. communic.), including species of *Monoculodes* and *Bathymedon.* Shoemaker (1955) recorded several high arctic genera and species of oedicerotids from Pt. Barrow, Alaska, slightly north of the present study region.

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Oedicerotid amphipods of the northwestern Pacific region, including the Sea of Okhotsk, Japan, western Bering and Chukchi Seas, are also fairly well known through the studies of Gurjanova (1936, 1938, 1951, et seq.), Bulycheva (1952), and Kudrjaschov & Tzvetkova (1975). Nagata (1965), Hirayama (1986, 1987, 1992), Morino (1990), Jo (1990), Ishimaru (1994) and others have recorded a rich oedicerotid fauna from Japan, Korea, and the coast of China south to Hong Kong.

The present study, involving several hundred species-lots from more than 200 stations, attempts to amplify knowledge of the systematics and distributional-ecology of the oedicerotid supergenera *Monoculodes* and *Synchelidium* in the northwestern Pacific region and establish their relationships with the better known faunas to the south and to the northwest of the study region.

The systematics of the genus *Monoculodes* represents a special taxonomic challenge in Carcinology. Prior to the present study, more than 50 species of the genus had been recorded from coastal shelf and bathyal waters, almost exclusively from cold-water regions of the northern hemisphere. Much of the early work, notably by Boeck (1871), Sars (1895), and Stebbing (1906), and more recently by Stephensen (1931), Gurjanova (1951), and Ledoyer (1993), was based on the fauna of northwestern Europe. Frequently, the original descriptions are incomplete and do not treat (or figure) taxonomically significant features of the mouthparts, uropods, coxal gills and/or brood plates The type of the genus, *Monoculodes demissus*, was only briefly diagnosed and not figured by Stimpson, 1853, and further material has never been identified nor redescribed. Its detailed taxonomic status is therefore only marginally, but legitimately, definable. However, the enormous wealth of material that accrued from the field materials above has facilitated the solution of many of these problems. We leave the degree of credibility and usefulness of the results to be decided by our reviewers, and by future students of the group.

ACKNOWLEDGEMENTS

The present study involved the assistance of many scientific agencies and interested colleagues. Especially helpful in the field work, acknowledged in pertinent station list publications of the seniro author (ELB) elsewhere (e.g., Bousfield (1958, 1959, 1961, 1963; Bousfield & McAllister (1963); and Bousfield & Jarrett (1981)), have been Dr. Colin Levings, Dr. Dan Quayle, and officers of the Department of Fisheries and Oceans (formerly Fisheries Research Board of Canada) at West Vancouver and Nanaimo, respectively; Drs. Andrew Spencer, Ian Nash, and research colleagues at the Bamfield Marine Station; the late Drs. Clifford and Josephine (Babs) Carl, Royal British Columbia Museum; Ottawa museum colleagues Fahmida Rafi and Eric Mills (now at Dalhousie University, Halifax, N. S.), and my late wife, Barbara, and my children Marjorie, Kathy, Mary, and Kenneth, who assisted very capably at the intertidal shore stations over the years. More recently, Marjorie provided helpful translations of much of the pertinent Russian literature.

The authors acknowledge a special debt of gratitude to Dr. Pierre Brunel, Université de Montréal, Québec, who provided laboratory space and facilities where most of the work of identification and collation of data was conducted. The Canadian Museum of Nature, Ottawa, provided curatorial space and facilities and loan of most of the amphipod material. Valuable material from the Bering Sea region was provided by Drs. Peter Slattery, Moss Landing, California, and Charles O'Clair, Auke Bay, Alaska. Material dredged from deep fiords of the coast of British Columbia by Dr. C. R. Levings and colleagues of the Pacific Environmental Station, West Vancouver, has greatly enhanced the scope of this treatment.

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SYSTEMATICS

Oedicerotidae Liljeborg, 1865

Oedicerotidae Liljeborg, 1865: 18.—Stebbing, 1906: 235. —Gurjanova, 1951: 518.—Lincoln, 1979: 336;—Barnard & Barnard, 1991: 547.—Ishimaru, 1994: 61.—Ledoyer, 1993: 579.

Oedicerotoidea (part)—Bousfield, 1982: 265.

Type Genus: *Oediceros* Kroyer, 1842: 155.—Stebbing, 1906: 243.

Component North Pacific Genera. *Acanthostepheia* Boeck, 1871: 163; *Aceroides* G. O. Sars, 1895: 340; *Arrhis*, Stebbing, 1906: 248, 726; *Bathymedon* G. O. Sars, 1895: 332; *Chitonomandibulum* Jo, 1990; *Cornudilla* Barnard & Karaman, 1991: 557; *Finoculodes* J. L. Barnard, 1971: 49; *Hongkongvena* Hirayama, 1992: 140; *Machaironyx* Coyle, 1980: 197; *Monoculodes* Stimpson, 1853: 54; *Monoculopsis* G. O. Sars., 1895: 310; *Oediceroides* Stebbing, 1888: 843; *Oediceropsis* Liljeborg, 1865: 10; *Paroediceros* G. O. Sars, 1895: 291; *Perioculodes* Sars 1895: 312; *Pontocrates* Boeck, 1871: 171; *Sinoediceros* Shen, 1955: 85; *Synchelidium* G. O. Sars, 1895: 317; *Westwoodilla* Bate, 1857: 139.

Diagnosis of the family. Body smooth, occasionally dorsally toothed or carinated. Peraeon segments short, compressed, coxae deep. Pleon segments large, plates large, deep. Head large, rostrum usually strongly developed, with acute, often deflexed apex. Eyes large, typically fused mid-dorsally at base of rostrum, often sexually dimorphic, lacking in some bathyal forms. Antennae medium, sexually dimorphic, aesthetascs and brush setae (but rarely calceoli) present in males. Antenna 1 usually shorter than antenna 2, lacking accessory flagellum.

Upper lip rounded or slightly indented below. Lower lip broad, inner lobes variously separated or fused medially. Mandible, molar usually large, titurative, or reduced to a small spinose nubbin; incisor variously toothed, occasionally smooth; palp slender, 3-segmented, often weakly setose. Maxilla 1, inner plate with few apical setae; outer plate 7-9 spinose, palp 2-segmented. Maxilla 2, plates small, weakly armed. Maxilliped strong; inner plates small; outer plates large, with inner marginal masticatory spines; palp stout, strongly dactylate.

Gnathopods 1 & 2 usually strongly subchelate, occasionaly cheliform, trending to dissimilarity in size and form, rarely sexually dimorphic; carpal lobes variously produced postero-distally, tending to guard the hind margin of the propod.

Peraeopods fossorial; in paired combinations of short subsimilar peraeopods 3 & 4, subsimilar peraeopods 5 & 6, and large, elongate peraeopod 7, with elongate dactyl. Dactyls of peraeopods 3-6 large to very small, nails often with apical chitinous rings.

Pleon plates 2 and 3, hind corners usually obtuse or broadly rounded, rarely acutely produced. Pleopods strong, sexually dimorphic. Uropods 1-3 slender, with strong peduncles and slender, subequal, weakly armed, acute rami that lack apical spines.

Telson short, subrectangular, entire, apical margin gently rounded, subtruncate or weakly incised; penicillate setae distal.

Coxal gills large, sac-like, on peraeopods 2-6. Brood plates narrow, strap-like,with elongate marginal setae.

Taxonomic and Distributional commentary. The phyletic placement of family Oedicerotidae within superfamily Oedicerotoidea, and within reproductively free-swimming superfamilies of gammaridean Amphipoda, is treated by Bousfield & Shih (1994). An updated key to world genera of family Oedicerotidae is provided by Barnard & Karaman (1991).

Family Oedicerotidae comprises about 200 described species in 35 genera, numbers that are increased by about 10% as a result of the present study of the North Pacific fauna The group is essentially arctic and arctic-boreal in distribution, ranging into the deep sea and Antarctic deep shelf and bathyal waters, with a few warm-temperate and subtropical representatives in oceans of the northern hemisphere.

The *Monoculodes* and *Synchelidum* generic complexes: distinctive features. These two generic macrogroupings represent the most advanced stages of evolutionary thrust within family Oedicerotidae. In both groups, the gnathopods trend towards elongation of the propod and corresponding elongation of the sensory posterior carpal lobe which, in the most advanced condition, becomes fused with the posterior margin of the propod. The carpus, propod and dactyl thereby form an attenuated subchelate or cheliform appendage that serves in deposit feeding (Enequist, 1949), or detecting and capturing small prey organisms (e.g., foraminiferans) within soft bottom sediments. A burrowing function is also not inconceivable. Early and intermediate stages in this evolutionary sequence are here demonstrated within various genera of the *Monoculodes* complex; later stages of the series typify various genera of the *Synchelidium* complex.

The mouthparts differ strongly (see Enequist, 1949; and below). In the *Monoculodes* complex, the mandibular molar is essentially large and triturative in function. In the *Synchelidium* complex, the molar is much reduced, nubbin-like, and bears apical spine(s) that may function as additional blade(s) of the spine row.

Other morphological differences are more apparent. Monoculodids tend to be larger in size (8-20+ mm) whereas synchelidiids are small, few exceeding about 6 mm in body length. Many species of monoculodids, esp. within genus *Monoculodes* sens str., lack pigmented eyes, whereas the eyes of all known synchelidiids (except *Finoculodes*) are essentially pigmented.

A major distributional difference, as noted below, is that *Monoculodes* group members are predominantly arctic and arctic-boreal, with relatively few species penetrating warm-temperate and tropical surface waters. They also occur at bathyal depths in northern and southern hemispheres. By contrast, syncheliid components are almost exclusely warm-temperate and tropical in the northern hemisphere. Members are restricted almost exclusively to the eulittoral zone; none (except *Finoculodes*) is bathyal.

Monoculodes Stimpson (sens. lat.)

Monoculodes Stimpson, 1853: 54.—Sars, 1895: 294.—Stebbing, 1906: 258.—Gurjanova, 1951: 562.—Barnard, 1969: 383.—Lincoln, 1979: 349.—Barnard & Karaman, 1991: 559.—Ledoyer, 1993: 587.

Type species. *Monoculodes demissus* Stimpson, 1853, monotypy.

Genera. *Monoculodes* Stimpson, 1853; *Hartmanodes,* new genus; *Rostroculodes,* new genus; *Deflexilodes,* new genus; *Limnoculodes,* new genus; *Ameroculodes,* new genus; *Kroyera* Bate, 1857 (revived status); *Pacifoculodes,* new genus; *Monoculopsis* Sars, 1895.

Taxonomic commentary: The genus *Monoculodes* has been defined (authors above) to encompass oedicerotids that have medium to large subchelate gnathopods in which the carpal lobes are variously enlarged and directed distally, often closely guarding (but not fused with) the posterior margin of the propod. Such a broad definition has included several very distinct species complexes that in other taxonomic family groups (e.g., Gammaridae) would long ago have been given separate generic status (see Bousfield, 1977).

Revision of this large and unwieldy genus has been been complicated by the growing number of world species included under the generic name *Monoculodes*, the lack of a rigorously defined type species or extant type specimen that can be rediagnosed, and the lack of material from broad regions of distribution of the entire species complex. Few original authors have treated the mouthparts in any detail, and these are, potentially at least, of phyletic and classificatory significance,

Barnard and Karaman redefined the genus based on *Monoculodes carinatus* Boeck, a species that has been described and figured in detail (e.g., by Sars, 1895; Ledoyer, 1993). Unfortunately, and as shown below, *M. carinatus* does not conform with many of the generic features listed by Stimpson (loc. cit.) nor does it occur even broadly within the North American Atlantic region, let alone near the nominate type locality. The authors have therefore reassessed and re-validated Stimpson's original diagnosis of the genus *Monoculodes* and its type species *M. demissus.*

Principal diagnostic features within genera of the *Monoculodes* complex are illustrated in Figure 1. Such features have been variously utilized in keys to regional and world species groups, notably by Gurjanova (1951), J. L. Barnard (1962), and Bousfield (1973), among others. Here the features are arranged in roughly phyletic series, trending generally from a plesiomorphic condition (top) to an apomorphic state (bottom). Plesio-apomorphic assessment of character states is derived from comparison with more primitive outgroup oedicerotoidean families such as the calceolate Exoedicerotidae and Paracalliopiidae that are almost exclusively austral, littoral and/or estuarine in distributional ecology (Bousfield, 1982; Barnard & Karaman, 1991).

With respect to the structure of the rostrum, the plesiomorphic condition is a relatively straight-tipped process, the apex acute and relatively little deflexed, with dorsally approximated eyes located basally, mainly on the head proper (e.g., D, E, H) or more distally on the rostrum (A, B, J). In a more advanced condition, the rostral apex is strongly deflexed (e.g., F, G) and, in the most advanced state, the apex is subtruncate and the eye apical (e.g., C).

With respect to gnathopod 1, in the most plesiomorphic condition of the carpus, the anterior margin is elongate and the carpal lobe is short, not reaching the palmar angle (e.g., A, B, C, D), intermediate in barely reaching the palmar angle (e.g., E, F, G,), and advanced in exceeding the palmar angle (e.g., H, J). The propod, plesiomorphically, is relatively short and broad (deep) (e.g., A, B, C, E), but is apomorphically elongate and relatively narrow (e.g., D, F, H, J). The posterior margin of the propod, in more advanced state, may be slightly deflexed distally, resulting in a slightly concavity of the posterior margin (e.g., B, G, H (some), J).

Similar trends are discernible in gnathopod 2. However, the carpal lobe is always more slender and attenuated and, in the more advanced state, it closely approximates ("guards") the posterior margin of the propod (e.g., F, G, H) which distally narrows in the most advanced condition (e.g., J).

With respect to peraeopods 1 & 2, in the plesiomorphic condition, the distal segments (4-6) are slender and weakly setose and the dactyls are relatively long and slender (e.g; A, B, D). In the apomorphic condition, segment 4 (especially) is distally broadened and strongly setose, and the dactyls are short (e.g., E, G, H, J). These states are intermediate in other genera (e.g., C, F). In the plesiomorphic state, segment 5 is more elongate than segment 6 (e.g., D, E, H, J,) but shorter than segment 6 in the advanced state (e.g., A, B, C, F, G) With respect to the basis of peraeopod 7, in the plesiomorphic condition the proximal portion is relatively narrow, and the posterior (lower) lobe is vestigial or lacking (e.g., A, B, C , F, G). In the advanced state, the basis is broad and the posterior lobe well developed, often deeper than the ischium (e.g., D, E, H, J).

Monoculodes Stimpson (sens. str.)

Monoculodes Stimpson, 1853: 41.
Monoculodes Stimpson (part) Sars, 1895: 294.—Stebbing, 1906: 258.—Shoemaker, 1930: 60.—Bousfield, 1973: 95.—Barnard & Karaman, 1991: 559.

Type species: *Monoculodes demissus* Stimpson, 1853: 41, monotypy.

Species (Northern hemisphere): *Monoculodes brevirostris*, new species (p. 89); *M. castalskii* Gurjanova, 1951; *M. coecus* Gurjanova, 1946; *M. diamesus* Gurjanova, 1936; *M. diversisexus* J. L. Barnard, 1967; *M. emarginatus*, J. L. Barnard, 1962; *M. glyconicus* J. L. Barnard, 1962; *M. latimanus* Boeck; *M. latissimanus* Stephensen, 1931; *M. mertensi* Gurjanova, 1951; *M. necopinus* J. L. Barnard, 1962; *M. packardi* Boeck, 1971; *M. perditus* J. L. Barnard, 1971; *M. recandesco* J. L. Barnard, 1967; *M. semenovi* Gurjanova, 1938; *M. sudor* J. L. Barnard, 1967. (17 species). **Southern hemisphere):** *M. abacus* J. L. Barnard, 1961; *M. antarcticus* K H. Barnard, 1932; *M. jazdzewskii* De Broyer, 1980; *M. scabriculosus* K. H. Barnard, 1932. (4 species).

The identity of the genus *Monoculodes*, and its type species, *Monoculodes demissus* Stimpson. Stimpson's original diagnoses of the genus *Mon-oculodes* and type species *M. demissus* are generalized, with few diagnostic features included. The text is unaccompanied by illustrations. Of the mouthparts, brief reference is made the mandibular palp and, in somewhat more detail to the maxilliped. Stimpson did not ascertain sexual dimorphism, although his comments on relative lengths of the antennae suggest that his specimens were probably mature females and/or larger immatures. Topotypes or other local species have not been identified subsequently. Stimpson's character states are therefore difficult, but not impossible, to apply to modern diagnoses of species and/or species groups within the *Monoculodes* group of oedicerotids. The diagnoses are repeated here, verbatim from the original text:

"Body tumid anteriorly, with the eyes so close together as to appear one. Superior antennae without accessory flagellum; inferior ones subpediform. Legs of the first two pairs with large subcheliform hands, formed of the last two articles of each; the antepenultimate joints having their inferior apices produced into slender thumbs. Legs of the

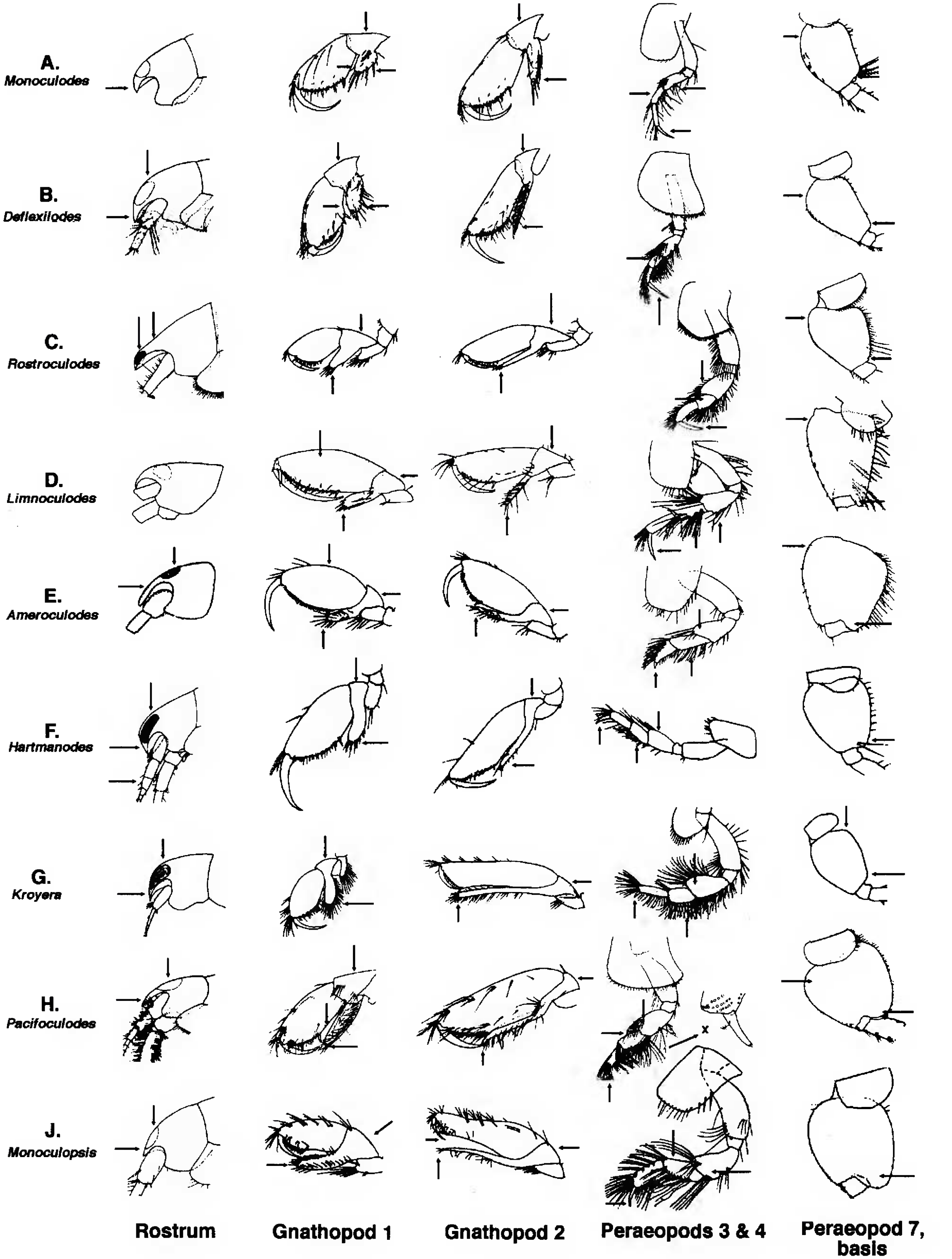

FIG. 1. GENERA OF THE *MONOCULODES* COMPLEX AND PRINCIPAL CHARACTER STATES

KEY TO GENERIC GROUPS WITHIN THE *MONOCULODES* SUPER GENUS

1. Gnathopods 1 & 2 propods short, broad, subsimilar, spine(s) at postero-distal angle long, slender; gnathopod 1, carpal lobe short, little or not exceeding mid point of propod; gnathopod 2, carpal lobe short, often less than half propod.. *Monoculodes* Stimpson (p. 81)
—Gnathopods 1 & 2, propods medium to elongate, generally dissimilar in size and form, postero-distal angle with short spine(s); gnathopod 1, carpal lobe large, extending more than half length of propod; gnathopod 2, carpal lobe elongate, length exceeding half posterior margin of propod .... 2.

2. Gnathopod 1, carpus large, length >depth; carpal lobe short, not reaching postero-distal angle; gnathopod 2 carpal lobe not reaching beyond postero-distal angle .... 3.
—Gnathopod 1, carpus short, anterior margin narrow, length less than depth; gnathopod 2, carpal lobe elongate, tip exceeding postero-distal angle of propod .... 6.

3. Peraeopod 7, basis, postero-distal lobe very small or lacking; peraeopods 3 & 4, segment 5 <segment 6; coxa 4 regular, not broader than deep, little produced posteriorly; uropod 3, rami subequal .... 4.
—Peraeopod 7, basis, postero-distal lobe distinct, extending variously onto ischium; peraeopods 3 & 4, segment 5 <segment 6; coxa 4, very large, acutely produced behind; uropod 3, rami unequal .... 5.

4. Rostrum elongate, apex deflexed, perpendicular, eye fully (usually distally) upon it; peraeopods 3 & 4, segment 4 strongly broadened and setose antero-distally; peraeopods 5 & 6 distinctly unequal in form and size; maxilla 1, outer plate with 7 apical spines .... *Rostroculodes*, n. g. (p. 91)
—Rostrum regular, apex acute, eye usually basal; peraeopods 3 & 4, segment 4 slightly broadened and moderately setose distally; peraeopods 5 & 6, subequal in form and size (6 slightly larger); maxilla 1, outer plate with 9 apical spines .... *Deflexilodes* n. g. (p. 97)

5. Gnathopod 1, propod larger than in gnathopod 2; peraeopods 3 & 4, dactyls medium, little shorter than segment 6; antenna 1, peduncular segment 3 short, < 13. segment 2 .... *Limnoculodes* n. g. (p.115)
—Gnathopod 1, propod not large than propod of gnathopod 2; peraeopods 3 7 4, dactyls minute; antenna 1, peduncular segment 3 about half length of segment 2 .... *Ameroculodes*, n. g. (p. 93)

6. Peraeopod 7, basis, postero-distal lobe large, usually extending below ischium; coxa 5 very large, depth nearly equal to coxa 4.. 7.
—Peraeopods 7, basis postero-distal lobe very small, shallow, or lacking; coxa 5 regular, depth distinctly less than coxa 4... 8.

7. Antenna 1, peduncular segment 3 elongate, length = segment 2; pleon plate 3, hind corner rounded; uropod 3, rami subequal in length .... *Monoculopsis* Sars (p. 115)
—Antenna 1, peduncular segment 3 short, <1/3 segment 2; pleon plate 3, hind corner obtuse, squared or variously produced; uropod 3, rami unequal .... *Pacifoculodes* n. g. (p. 102)

8. Pleon segments weakly mid-dorsally carinate; antenna 1 (female) extending beyond peduncle of antenna 2; peraeopods 3 & 4, segment 5 <<6 .... *Kroyera* Bate (p. 94)
—Pleon segments dorsally smooth; antenna 1 (female) shorter than peduncle of antenna 2; peraeopods 3 & 4, segment 5 >>segment 6 .... *Hartmanodes*, n. g. (p. 92)

posterior five pairs unguiculate (dactylate), those of the last pair being exceeding long. Caudal stylets all biramous; the rami being equal. Maxilliped large, elongate, with unguiform terminal articles, and internal lamellae of about one-half their length. Mandible palpigerous.

The genus resembles *Eusirus* in the structure of the hands, and *Oediceros* in its long posterior feet. "

Stimpson's diagnosis of the type species, *M. demissus*, contains character states of mostly generic (or higher level) significance), quoted as follows.

"Body smooth and shining, broad and thick anteriorly, and slender posteriorly; the abdomen constituting more than three-sevenths of the total length. Epimera of the first five pairs of considerable size; the rest very small. Head tumid, terminating anteriorly in a large subtriangular rostrum, curving downward; at the base of which above are the large vermilion-colored eyes, which are so near together as to appear one, even when viewed from above. Antennae thick-based and about equal in length, reaching the fourth thoracic segment; the superior ones with a much longer flagellum than the subpediform inferior ones. Legs of the first two pairs with large oval hands, strong fingers, and thumbs formed from prolongations from the antepenult joints, which are largest in the second pair. The remaining legs are simply unguiculate, the fifth and sixth pairs being very short, and the seventh of great length. Caudal stylets nearly smooth, of considerable length, tapering to fine points; the first pair reaching the extremities of the third. Colour wine yellow. Length, 0.35 inch (9.0 mm). Dredged in four fathoms, on a coarse sand and nullipore bottom, off Duck Island boat-moorings."

Allowing for some inaccuracy or distortion in his statements, Stimpson's combined diagnoses are undoubtedly those of an oedicerotid and a monoculodid, as its definition has been understood for the past 100 years (fide Sars, 1895; Stebbing, 1906). Unfortunately, his type material was apparently lost in the Chicago fire of 1871 (Manning et al, 1980?). Subsequent collections of amphipod crustaceans from that general region of the Bay of Fundy include those of the Biological Board of Canada (RV "Prince", 1913) which, though deposited in the CMN (Ottawa), have not yet been worked up and/or published upon.

Since *M. demissus* has not been identified in later literature, Stimpson's original species may prove synonymous with a subsequently described regional species. It is almost certainly a member of one of the generic groups encompassing known regional species. Watling (1981) combined earlier oedicerotid records mainly of Shoemaker (1930), Brunel (1970), and Bousfield (1973) to list 16 regional species of the *Monoculodes* group, as follows (major references in parentheses):

M. latimanus (Goes, 1966) (Shoemaker, 1930); *M. packardi* Boeck, 1871 (Shoemaker, 1930); *M. simplex* Hansen, 1887 (Gurjanova, 1951); *M. edwardsi* Holmes, 1905 (Shoemaker, 1930); *Monoculodes sp.* (=*M. edwardsi* Holmes cf. Bousfield, 1973, fide Barnard & Karaman, 1991); *M. borealis* Boeck, 1971 (Shoemaker, 1930); *M. schneideri* Sars 1895 (Shoemaker, 1930); *M. longirostris* (Goes, 1866); (Shoemaker 1930); *M. tenuirostratus* Boeck, 1871 (Shoemaker, 1930); *M. norvegicus* (Boeck, 1871) (Shoemaker, 1930); *M. tesselatus* Schneider, 1884 (Shoemaker, 1930); *M. tuberculatus* Boeck, 1871 (Shoemaker, 1930); *M. intermedius* Shoemaker, 1930 (Bousfield, 1973); and *Monoculopsis longicornis* Sars, 1895 (Shoemaker, 1930). Watling (loc. cit.) also listed *M. kroyeri* Sars, 1895, and *M. simplex* Hansen, 1887, as eastern North American marine faunal components but these have actually not been recorded closer to the Bay of Fundy (type locality of *M. demissus*) than the coast of Greenland.

Nearly all species (above) are inconsistent with Stimpson's generic and species diagnoses, based on what were very probably female specimens (above). Thus:

(1) Members of the *edwardsi* group of species have subequal antennae and deep coxal plates 1-5, but are now members of the genus *Ameroculodes* (p. 93). These are characterized by minute peraeopod dactyls (not "legs . .simply unguiculate") and by unequal, rather spinose, rami of uropods 1 & 2 that exceed the unequal rami of uropod 3 (not .." caudal stylets equal . . and nearly smooth, reaching the extremities of the third", as stated by Stimpson (loc. cit).

(2) members of the *longirostris* group, including *M. longirostris, M. kroyeri, M. schneideri*, and *M. borealis* are now members of genus *Rostroculodes* (p. 91). These are characterized by a strong, apically blunt rostrum that bears the eyes distally (not "eyes . . at the base of (the rostrum)" and coxal plates 1-5 are relatively small, rather than "of considerable size, the rest very small" of Stimpson (loc. cit.). Moreover, their gnathopod propods are small and unlike.

(3) Members of the *intermedius* group, containing *M. intermedius, M. norvegicus, M. tesselatus, M. tenuirostris*, and *M. tuberculatus* are now placed in the genus *Deflexilodes* (p. 97). These do tend to have relatively large coxa plates 1-5 and conspicuous dactyls on all the peraeopods, but the gnathopod propods are usually small, and/or dissimilar in size and form, and the carpal lobe of gnathopod 2 tends to be variously elongate and lying close to the propod, rather than projecting "thumb like" and "like *Eusirus*" (of Stimpson, above).

(4) In *Monoculopsis longicornis*, antenna 1 is longer than antenna 2, and the anterior coxae are large, but the rostrum is very short, the gnathopods small and very dissimilar, and the peraeopod dactyls are short.

The remaining species, *M. latimanus* and, to lesser extent, *M. packardi*, conform generally best with Stimpson's characters states of eyes, rostrum, antenna, gnathopods, peraeopod dactyls, uropod rami, and body length (~9 mm). These two species have also been recorded fairly commonly in nearby Gulf of St. Lawrence, at depths of 30-93 m., and *M. latimanus* is known elsewhere in depths as shallow as 4 m. (Shoemaker, 1930). The two species exhibit mainly plesiomorphic character states (Fig. 40, Table I) and are here selected as representative, in detail, of the genus *Monoculodes* based on *M. demissus* Stimpson, 1853.

Formal rediagnosis of *Monoculodes* Stimpson. Body smooth above. Rostrum short to medium, normal, eye basal, seldom fully on rostrum; anterior head lobe rounded. Antennae sexually dimorphic; short, weakly setose in female. Antenna 1, peduncular segment 2 medium, 3 medium; flagellum little exceeding peduncle of antenna 2, callynophorate in male. Antenna 2, peduncular segments 4 & 5 subequal; flagellum elongate in male.

Mouthparts not described but probably similar to those of *N. necopinus* and *N. castalskii*): Lower lip, inner lobes separate. Mandible, molar strongly triturative; left lacinia 5-dentate, right lacinia bifid; blades 4-7; incisor toothed; palp slender, segment 3 not longer than 2, with posterior marginal D-setae. Maxilla 1, outer plate typically with 9 apical spines; palp slender. Maxilla 2, plates regular. Maxilliped, inner plate with apical spine(s) and setae; outer plate tall, inner margin masticatory; palp slender, segment 2 little (or not) broadened.

Coxal plates 1-4 medium deep. Coxa 1 distally broadened; coxae 2 narrow to medium, weakly or not spinose behind. Gnathopods 1 & 2 not sexually dimorphic; bases short; propods stout, subsimilar, palmar angle with single slender spine. Gnathopod 1, propod regular, short, broadening distally, not deflexed, length 1-2 X depth; carpus longer than deep, hind lobe short, not reaching palmar angle.

Coxal plate 3 regular, larger than 2; coxa 4 regular, little broadened distally, lower margin convex. Peraeopods 3 & 4 , segments not strongly fossorial (setose); segment 5 < 6; dactyls medium to long, tips with chitinous ring. Coxa 5 medium, ~aequilobate. Coxa 6 regularly deep. Peraeopods 5 & 6 subsimilar in form, 6 slightly larger, segment 4 relatively long, not strongly expanded or setose; segment 5 shorter than 6; dactyls strong, >segment 6, tips usually with strong chitinous rings. Peraeopod 7, basis regular, not broadly expanded proximally, postero-distal lobe small, shallow.

Pleon plates 2 & 3, hind corners broadly obtuse or rounded. Uropods 1, 2, & 3, rami subequal, weakly spinose, tips extending subequally rearward. Telson short, apex truncate, shallowly rounded or weakly emarginate, apical margin with 2 unequal pairs of short spines and/or setae.

Coxal gills regular. Brood plate with strongly setose marginally and apically.

Distributional ecology: Members of the genus are subtidal to bathyal in coastal waters of the North Pacific, Arctic, North Atlantic, and a few are antiboreal, in deep water.

Taxonomic commentary: This large group is morphologically diverse and may lends itself to further subdivision at subgeneric, if not full generic level. Thus the *M. catalskii* group with short, *Bathymedon*-like rostrum, and bulging hind lobe of peraeopod 7 basis is distinctive. Species of the southern hemisphere (e.g., *M. abacus* and *M. jazdzewskii* are appear different in gnathopods and mouthparts (e.g., maxilla 1 with 7 outer plate spines in some species. Further analysis, without examining material, is beyond the scope of this study.

Monoculodes latimanus (Goes)
(Fig. 2)

Oediceros latimanus Goes, 1866: 527, fig. 23.
Monoculodes latimanus (Goes) Sars, 1895: 298, pl. 106, fig. 2.—Stebbing, 1906: 264.—Gurjanova, 1951: 583, fig. 390.—Shoemaker, 1955: 37.—Barnard, 1967: 77—Barnard & Karaman, 1991: 560.

Material Examined: 15 specimens in 10 lots, from southeastern Alaska to southern Vancouver Island.
ALASKA:
Southeastern Alaska, ELB Stn. S13F1, Off Sister Lake, gravel & algae, 3 m., July 31, 1980 - 1 immture specimen

BRITISH COLUMBIA:
North-central coast, ELB Stn. H36 (Safety Cove, Calvert I.), gravel, shells, 30-85 m. - female, br. II. (9.0 mm), **fig'd specimen,** CMN cat. no. NMCC0990-1169 + 1 other female.
Swanson Bay, C. R. Levings Stns., 1975: - 7 specimens, in 5 samplings, postly penultimate males; Stn M#3 - male penultimate (9.0 mm), **fig'd specimen,** CMN cat. no. NMCC-1990-463.
Vancouver Island, south end. ELB Stn. P24 (Koskima Bay), 20-30 m., mud, silt, woody detritus, Aug. 14, 1975 - 1 immature specimen.
G. O'Connell Stns., Victoria, August, 1976: off Clover Pt. - 3 specimens; off McCauley Pt. - 1 immature specimen.

Diagnosis. Female br. II stage (9.0 mm). Rostrum short, deflexed. Eyes partly on base of rostrum. Anterior head lobe relatively narrow, upper corner subacute. Antenna 1longer than peduncle of antenna 2; peduncular segment short, setose; segment 3 > 1/2 segment 2; flagellum with 10+ segments. Antenna 2, peduncular segments stout, setose, segmeent 4 shorter than 5; flagellum of 50+ short segments.

Lower lip shallow, broad, inner lobes distinct. Mandible, left lacinia 5-dentate; spine row with 5-6 slender blades; incisor irregularly toothed; palp segment 3slender, shorter than segment 2. Maxilla 1, palp segment 2, outer margin convex, with 5 slender setae. Maxilla 2, inner plate broader than outer plate. Maxilliped, inner plate medium short, apex with tall spine and several setae; outer plate shorter, outer margin strongly convex; palp segment 2 somewhat broadened (distorted in slide mount).

Coxae 1-4 subequally deep, lower margins very strongly setose. Coxa 4 slightly produced behind. Gnathopod 1, basis with antero-distal cluster of longish setae; meral process very short; carpal lobe stout, very short; propod short strongly braodening distally, palm oblique, convex. Gnathopod 2, basis with weak antero-distal setal cluster; carpal lobe extending about 1/2 length of posterior margin of propod; propod subovate, length~2X depth; palm strongly oblique.

.Peraeopods 3 & 4 fossorial, segment 4 moderately expanded and setose distally; dactyls slender, not longer than segment 6. Coxa 5 broad, aequilobate. Peraeopod 6, basis larger than in peropod 5. Peraeopods 5 & 6, dactyls shorter than segment 6, chitinous rings vestigial. Peraeopod 7, basis broad, narrowing distally, hind margin slightly bowed, strongly setose; lower lobe small.

Pleon plates 2 obtusely rounded behind, margins nearly bare. Uropod 1, rami subequal, shorter than peduncle, margins with short spines. Uropod 2, outer ramus shorter. Uropod 3, rami subequal.

Telson short, broad, apical margin convex, armed with 4 slender setae. Coxal gills large, broadly sac-like, rounded distally. Brood plates partly developed, lacking marginal setae.

Male penultimate stage (9.0 mm): Antenna 1, peduncular segments 2 and 3 very short; flagellum ~17-segmented, extending beyond peduncle of antenna 2. Antenna 2, flagellum ~60-segmented, much exceeding peduncle.

Distributional ecology. *Monoculodes latimanus* is here recorded from southeastern Alaska to the southern end of Vancouver Island, on mud and shell bottoms, to depths of more than 60 m.

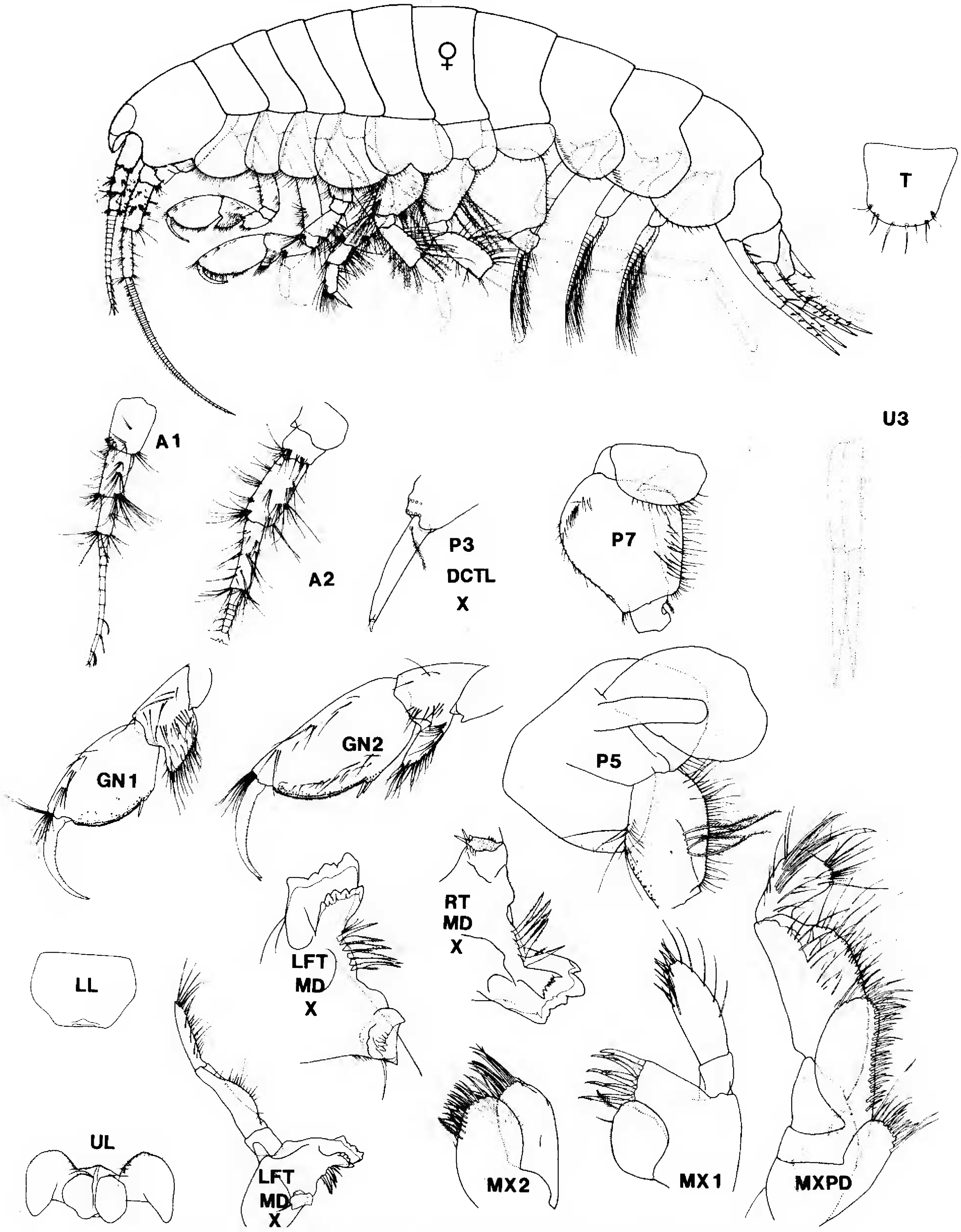

FIG. 2. *Monoculodes latimanus* Boeck. Safety Cove (H36), Calvert I., B. C. Female (9.0 mm); male (9.0 mm).

Taxonomic commentary. The present material appears very close to *M. latimanus* (Goes), as illustrated by Sars (loc. cit.). It differs from it in the relatively long peduncular segment 3 of antenna 1 (female), the more strongly setose apical margin of the telson, and a number of other relatively minor features. The incomplete nature of the present material, mostly lacking distal segments of the peraeopods, mitigates against recognizing such differences at formal species level.

KEY TO NORTH PACIFIC SPECIES OF *MONOCULODES* SENS. STR.*

1. Eyes pigmented; sublittoral and shelf species . . . . .2.
—Pigmented eyes lacking ; mostly bathyal species . . . . 11.

2. Rostrum very short, little or not exceeding anterior head lobe; peraeopods 3 & 4, segment 4 stout, distally strongly setose; peraeopod 7, basis with postero-distal bulge . . . . 3.
—Rostrum regular, apex distinctly exceeding anterior head lobe; peraeopods 3 & 4, segment 4 normal, not exceptionally tout or setose antero-distally; peraeopod 7, basis lacking lobe . . . . 4.

3. Gnathopod 1, propod large; antenna 1 shorter than antenna 2 . . . . *M. castalskii* Gurj. (p. 87)
—Gnathopod 1, propod regular; antenna 1 longer than antenna 2 . . . .*M. brevirostris* , n. sp. (p. 89)

4. Telson, apex variously notched or indented . . . . 5.
—Telson, apical margin straight or slightly convex . . . . 6.

5. Gnathopod 2, propod short, deep; antenna 1, peduncle 2 >1 . . . . *M. emarginatus* J. L .Barnard (p. 85)
—Gnathopod 2, propod length ~1.5X depth; antenna 1, segment 2 <1 . . . . *latimanus* Boeck (p. 82)
6. Antenna 2, flagellum long, equal to, or longer than, peduncle . . . . 7.
—Antenna 2, flagellum shorter than peduncle. . . . . 10.

7. Rostrum medium, reaching 1/2 peduncular segment 1, antenna 1 . . . . *perditus* Barnard (p. 85)
—Rostrum regular, apex reaching nearly to end of peduncular segment 1, antenna 1 . . . . 8.

8. Gnathopod 1, carpal lobes short, weak; Pacific species . . . . *M. mertensi* Gurjanova
—Gnathopod 1, carpal lobes stout; Atlantic species . . . . 9.

9. Gnathopod 1, propod stout; uropods 1 & 2, rami long slender . . *M. demissus* Stimpson (TYPE, p. 78)
—Gnathopod 1, propod smaller than 2; uropods 1 & 2, rami shorter than peduncle . . *M. packardi* Boeck

10. Antenna 1, flagellum shor,t reaching ~end of peduncle of antenna 2; gnathopod 2, basis anterodistally setose . . . . *M. diamesis* Gurj. (p. 89)
—Antenna 1, flagellum long, exceeding peduncle antenna 2; gnathopod 2, basis weakly setose anterodistally . . . . *M. semenovi* Gurjanova.

11. Gnathopod 1, propod very broad distally, palm nearly vertical . . . . 12.
—Gnathopod 1, propod regular, length ~ 1.5X depth, palm oblique . . . . 13.

12. Rostrum very short; antenna 1, peduncular segment 2 <segment 1 . . . . *M. diversisexus* J. L. Barnard
—Rostrum exceeding anterior head lobe; peduncular segment 2 >> 1. . . . *M. latissimanus* Steph. (p. 87)

13. Rostrum short,not exceeding head lobe; telson, apical margin with median pair of short spines . . . 14.
—Rostrum normal, exceeding anterior head lobe; telson, apical margin with median pair of setae . . . . 15.

14. Gnathopods 1 & 2, carpal lobes short, < 1/2 propod; pleon plate 2 weakly setose . *M. recandesco* JLB
—Gnathopods 1 & 2, carpal lobes nearly reaching palm; pleon 2 strongly setose . . *M. necopinus* Barnard

15. Peraeopods 3 & 4, segment 6 setose behind; peraeopods 5 & 6, segment 6, posyterior margin strongly setose . . . . *M. sudor* J. L. Barnard
—Peraeopods 3 & 4, segment 6 lacking posterior marginal setae; peraeopods 5 & 6, segment 6, hind margin with a few setae only . . . . *M. glyconicus* J. L. Barnard

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* includes North Atlantic representative type species *M. demissus* Stimpson, and *M. packardi* Boeck but excludes western North Pacific species *M. dentimanus* Jo, 1990, *M. muwoni* Jo, 1990, and *M. koreanus* Jo, 1990.

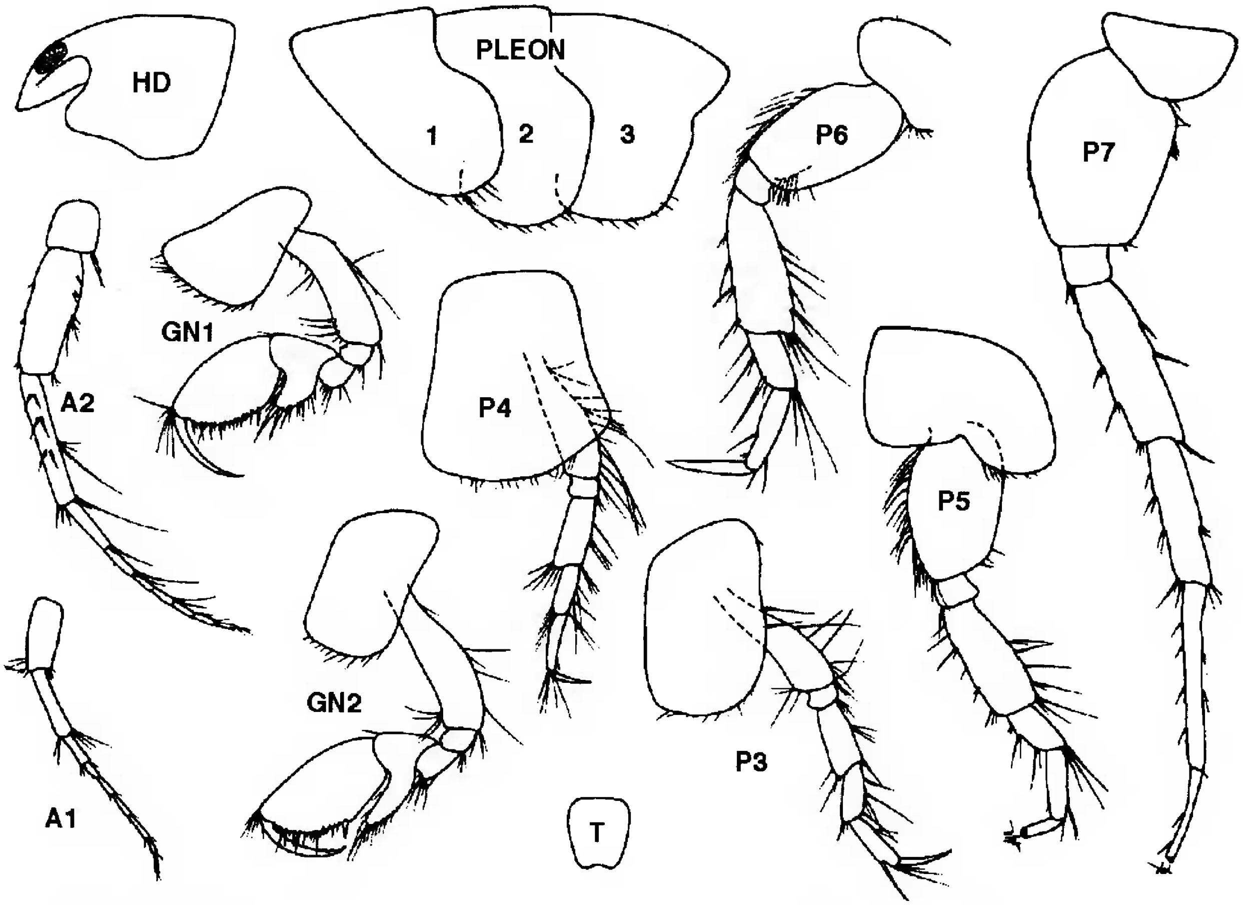

FiG. 3. ***Monoculodes emarginatus*** **J. L. Barnard. Southern California. Female (4.5 mm). (after Barnard, 1962)**

Monoculodes emarginatus J. L. Barnard
(Fig. 3)

J. L. Barnard, 1962e: 361, fig. 4.—Barnard, 1964: 234.—Barnard, 1966a: 76.—Barnard, 1966b:26—Barnard, 1971: 51.—Barnard & Karaman, 1991: 559.

Taxonomic commentary: The species was described and figured from material dredged off the coast of southern California in depths of 20-50 m. *Monoculodes emarginatus* differs from the co-occurring *M. latimanus* Boeck in its more elongate carpal lobe of gnathopod 2, the less broad basis of peraeopod 7, and the distinctly emarginate, weakly armed apical margin of the telson.

The species is very similar to *Monoculodes perditus* Barnard (see below). However, *M. emarginatus* differs in its emarginate telson, relatively straight rostrum (female), shorter dactyls of peraeopods 3 & 4, staighter hind margin of the basis of peraeopod 7, and less strongly rounded hind margin of pleon plate 3.

The mouthparts of *M. emarginatus* have not yet been described. Their detailed comparison with those of *M. perditus* awaits re-eaxamination of type material.

Distributional Ecology. From Oregon to Baja California, on fine mud, at depths of 55-200+ m.

Monoculodes perditus J. L. Barnard
(Fig. 4)

Monoculodes perditus J. L. Barnard, 1966: 77, fig. 30.—Barnard & Karaman, 1991: 560.

Material Examined. 86 specimens from 16 localities:
BRITISH COLUMBIA:
North-central mainland coast. ELB Stns., July, 1964: H21, H24 H36, H37 - 75 specimens.
C. Levings. Stns., Swanson Bay, 1975: M#1, M#3, M#5, JC - 7 males, females, immatures.
C. Levings Stns)-4a (Ocean Falls) - 1 specimen.
Vancouver Island, south end. ELB Stns., July, 1975: - P13; P24; P25; P24); P26 - 25 males, females, immatures.
ELB Stns., July, 1976, B21b (off Brady's Beach), sand algae, woody debris at 10-20 m. - Female (6.0 mm), male (6.0 mm), **fig'd specimens,** CMN cat. no. NMCC1990-483; also B24; B26; B27; B28 - 10 specimens.
ELB Stns., May, 1977: Stn P21a, 44 m., fine sand.
K E Conlan Stns., French Creek, 1977- 1 specimen.
G. O'Connell Stns., Aug., 1976: W7b, W153b - 4 specimens CMN collections, Ottawa.

Diagnosis. Female subad. (6.0 mm). Rostrum medium strong, deflexed. Eyes basal on rostrum. Anterior head lobe

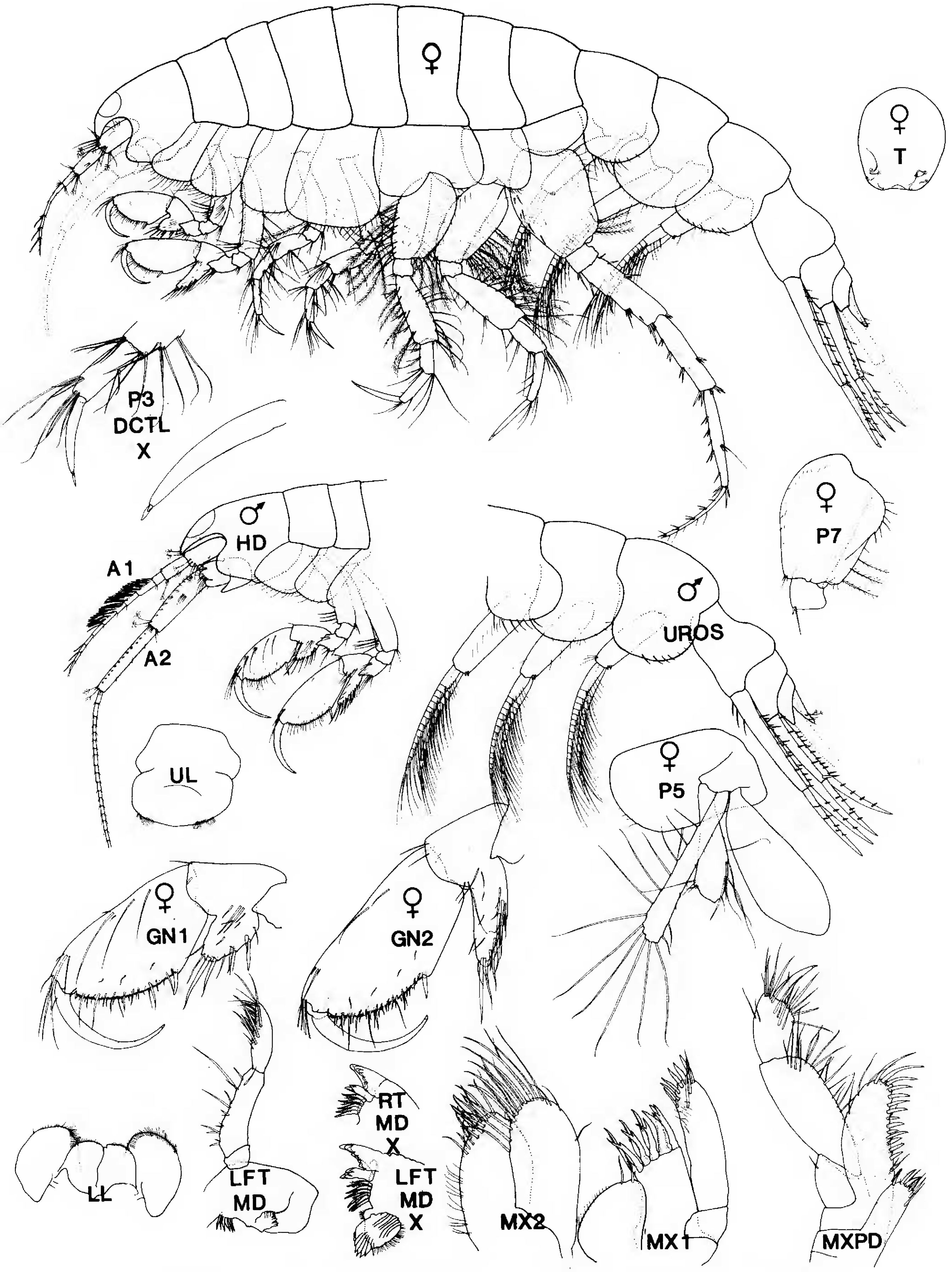

FIG. 4. *Monoculodes perditus* J. L. Barnard. Off Brady's Beach (B21b), B. C.. Female (6.0 mm); male (6.0 mm)

bluntly rounded. Antenna 1 slightly longer than peduncle of antenna 2; peduncular segment 2 short, setose; segment 3 ~ 1/2 segment 2; flagellum with 6-7 segments. Antenna 2, peduncular segments stout, setose, segment 4 slightly shorter than 5; flagellum and peduncle subequal in length.

Lower lip shallow, broad, outer lobes large. Mandible, left lacinia 5-dentate; spine row with 5-6 slender blades; incisor irregularly toothed; palp relatively short, stout, segment 3 shorter than segment 2. Maxilla 1, palp slender, outer margin lacking setae. Maxilla 2, plates subequal in width. Maxilliped, inner plate strong, apex with 3 tall spines and several slender setae; outer plate medium tall, outer margin convex, with a few distal setae; palp segment 2 slender, segment 3 and dactyl relatively short.

Coxae 1-4 broad, increasing in depth posteriorly, lower margins moderately setose. Coxa 4 broad, not produced behind. Gnathopod 1, basis with small antero-distal cluster of longish setae; meral process short; carpal lobe stout, short; propod medium, palm oblique, longer than hind margin. Gnathopod 2, basis with weak antero-distal setal cluster; carpal lobe extending 2/3 length of posterior margin of propod; propod broadening distally, length >2X depth;palm and posterior margin subequal in length.

Peraeopods 3 & 4 weakly fossorial, segment 4 little expanded or setose distally; dactyls slender, longer than segment 6, tips with minute chitinous rings. Coxa 5 broad, relatively shallow, aequilobate. Peraeopods 5 & 6 closely subequal; segment 4 little broadened; dactyls slender, longer than nearly bare segment 6. Peraeopod 7, basis little broadened, hind margin indented, lower lobe small.

Pleon plate 2 brodly rounded behind, margin nearly bare. Uropods 1 & 2, rami short, subequal. Uropod 3 not present.

Telson short, broad, outer margins convex; apical margin shallowly incised,very weakly armed. Coxal gills elongate, saclike, distally subacute. Brood plates slender, strap-like, margins sparsely long-setose.

Male (5.5 mm): Rostrum less strongly deflexed. Antenna 1, proximal flagellar segments callynophorate but not conjoint. Antenna 2, peduncular segments 4 & 5 elongate, anterior margin with fine brush setae; flagellum elongate.

Distributional ecology. In subtidal shelf waters, on sandy silt, in depths of 20-200 m., from northern British Columbia, through Oregon to southern California.

Taxonomic commentary. Except for its larger size, the material from British Columbia compares in detail with the small (2.9 mm) male (?) specimens of *M. perditus* taken at depths of 180 m. off southern California and figured by Barnard (loc. cit). In the larger B. C. material (fig.) the propods of gnathopods 1 & 2 are larger and more elongate, and the coxal plates, esp. coxa 4, are broader, than in the small Californian specimens. Barnard (loc. cit.) further distinguished this species from similar and related species of the North Pacific region such as *M. coecus* Gurj. 1951, *M. diamesus* Gurj., and *M. latimanus* (Goes), here supported by the phenogram of species of *Monoculodes* (Fig. 40, p. 140).

Monoculodes latissimanus Stephensen
(Fig. 5)

Monoculodes latissimanus Stephensen, 1931: 244, fig. 70.—Gurjanova, 1951: 585, fig. 392.—Barnard,1966: 76, fig. 29.—Barnard 1967: 113, figs 521-c.—Barnard & Karaman, 1991: 560.

Taxonomic and distributional commentary. Barnard (loc. cit.) has recorded the species at bathyal depths from off the coast of Oregon and California. It probably occurs also off the coast of british Columbia, but none was taken in study material. The species ranges elsewhere from Greenland ro Davis Strait, at depths to 1096 m. It also ranges southwards along the North American Atlantic coast in high latitudes, at least to the Gulf of St. Lawrence (Shoemaker, 1930) and probably also the Bay of Fundy (Watling, 1979).

The species is suyperfically similar to the following eyeless species, *M. brevisotris*, n. sp., but is distinguished by its longer rostrum, shorter antenna 1, and shorter broader gnathopod propods.

Monoculodes castalskii (Gurjanova)
(Fig. 6)

Monoculodes castalskii Gurjanova, 1951: 572 , fig. 377.—Barnard, 1967: 358 (key).—Barnard & Karaman, 1991: 559.

Material Examined.
ALASKA:
Aleutian Islands. Unimak I., P. Slattery Stns., 1982: C77 - 2 female subadult speciemens (10.0 mm); C79 - 3 immature specimens (to 5.0 mm); C127 - 1 immature. CMN collections, Ottawa. .

Taxonomic and distributional commentary. Gurjanova's original description and figures of 12 mm female specimens of *Monoculodes castalski* do not treat the mouthparts. However, in present specimens, the mouthparts appear similar overall to those of *M. brevirostris* (fig.). Antenna 1 is described as slightly shorter than antenna 2. The chitinous rings of the tips of the dactyls, especially of peraeopods 5 & 6, are relatively large. The postero-distally bulging hind lobe of the basis of peraeopod 7 appears typical of this group of species

Distributional Commentary. *Monoculodes castalskii* has been recorded from the Sea of Japan Sea and the Kara Sea at depths of 80-290 m. On the North American Pacific coast the species has not been recorded south of the Aleutian Chain.

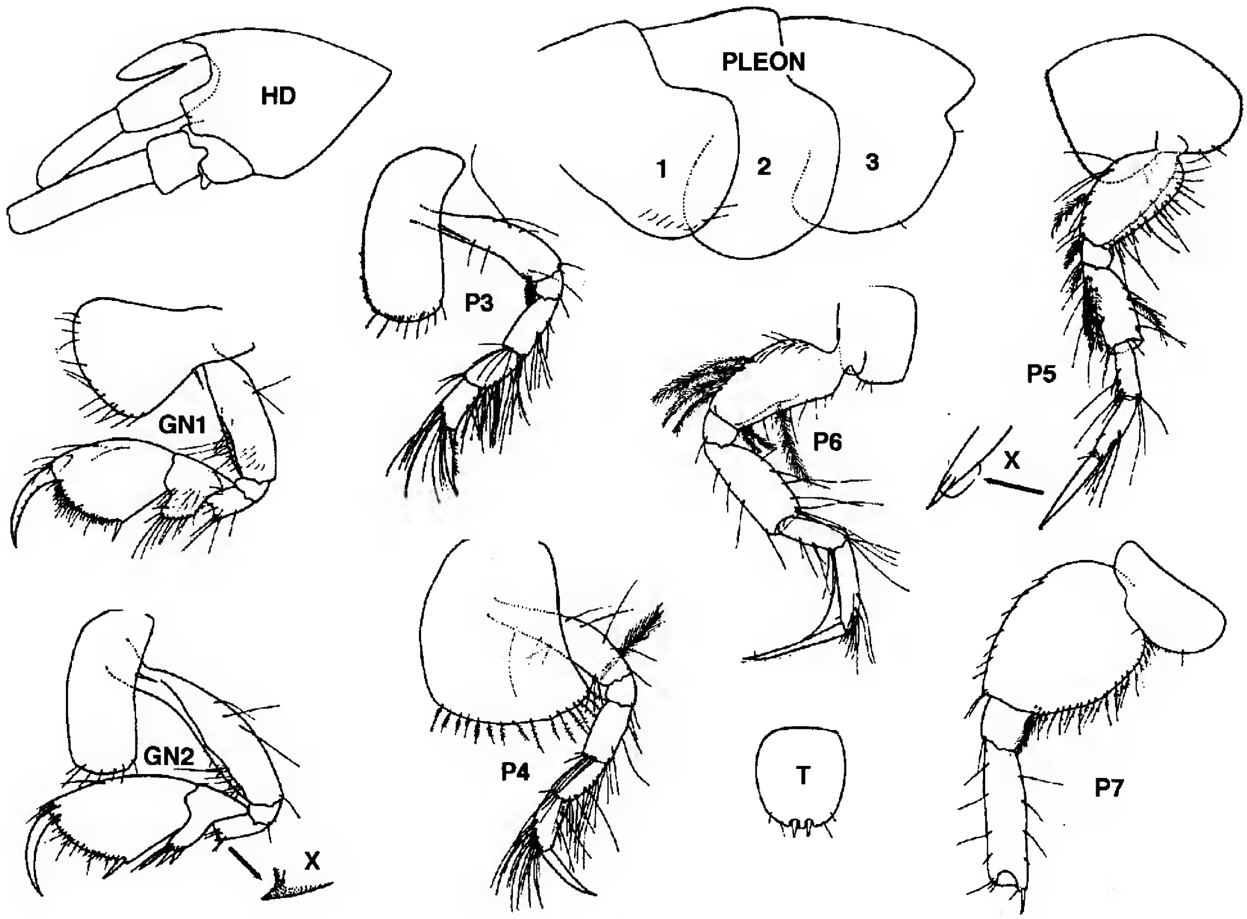

FIG. 5. ***Monoculodes latissimanus*** **Stephensen, 1931. Off Southern California. Female (3.0 mm). (After Barnard, 1966).**

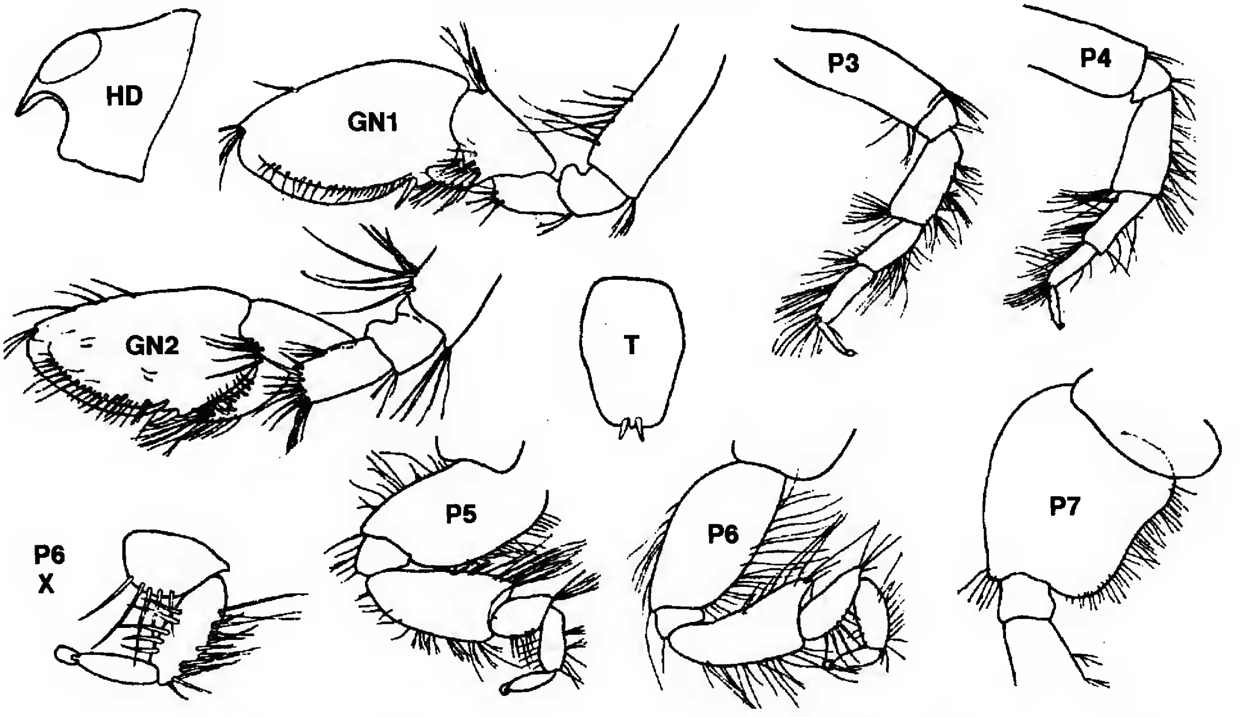

FIG. 6. ***Monoculodes castalskii*** **Gurjanova. Kamchatka & Bering Sea regions. Female (12.0 mm).**

Monoculodes brevirostris, new species
(Fig. 7)

Material examined:
BRITISH COLUMBIA:
South-central mainland coast. ELB Stns. P1-P8, (Burrard Inlet & vicity), fine mud and woody detritus, at depths of 44-240 m, Nov. 2-4, 1977. About 80 specimens, nearly all subadult, at 8 dredge stations including:
Stn. P7, Queen Charlotte Channel, south of Bowen Island, 240 m., mud and woody detritus, in association with a rich amphipod and decapod fauna - 1 female ov (11.0 mm), **Holotype**, CMN Cat. No. NMCC-1991-0409.
ELB Stn. E5 (Indian Arm, south channel), mud, coarse dand at 60 m., Nov. 4, 1977 - 1 female.
CMN collections, Ottawa.

Diagnosis. Female ov (11.0 mm): Rostrum very short, *Bathymedon*-like. Eyes weakly pigmented, barely impinging on base of rostrum. Anterior head lobe relatively narrow, upper corner subacute. Antenna 1 <antenna 2; flagellum of 40+ medium segments. Antenna 2, peduncular segments 4 & 5 subequal in length; flagellum of 25+ short segments.

Mandible, left lacinia 6-dentate; spine row with 4-5 slender blades; palp segment 3 medium, slender, inner margin with elongate "D" setae. Maxilla 1, palp stout apex broad, oblique. Maxilliped, outer plate tall, slender; palp segment 2 slightly broadened, inner distal margin oblique.

Gnathopod 1, basis, with antero-distal cluster of short setae; carpal lobe stout, propod little longer than carpus, hind margin nearly straight, about equal in length to palm. Gnathopod 2, basis with weak antero-distal setal cluster; carpal lobe narrowing sharply extending about 1/2 length of posterior margin of propod that is longer than the palmar margin.

Coxa 3 relatively broad, lower margin shallowly incised. Coxa 4 nearly as broad as deep, hind corner acute. Peraeopods 3 & 4, dactyls not longer than segment 6, chitinous rings minute. Coxa 5, weakly postero-lobate. Peraeopods 5 & 6, dactyls ~equal in length to segment 6. Peraeopod 7, basis narrowing distally, hind margin normally setose, lower hind lobe shallow, broadly rounding; posteromedially with 2-3 long plumose setae..

Pleon plates 2 & 3, broadly rounded behind. Uropods 1 & 2 rami shorter than peduncle, margins each with 2-4 short spines. Uropod 3, rami longer than peduncle , margins 4-5 spinose., telson subrectangular, apical margin with 2 short spines and 2 short setae at the corners.

Etymology. From the Latin "brevis" - short, and "rostrum" -frontal process, with reference to the very short rostrum.

Distributional ecology. Known only from medium deep muddy sediments in Burrard Inlet; probably occurring in other fiords northward along the mainland coast of British Columbia.

Taxonomic commentary. *Monoculodes brevirostris* is very similar to *A. castalski* Gurjanova that has been recorded from Bering Strait to the Sea of Japan (Gurjanova, 1951). In the latter species, however, the rostrum is longer, the propod of gnathopod 1 much stronger, segments 5 & 6 of peraeopods 5 & 6 are more strongly spinose, the telson is broadest medially, and its paired apical marginal spines are much stouter and closer together.

Monoculodes diamesus Gurjanova
(Fig. 8)

Monoculodes diamesus Gurjanova, 1936: 564, fig. 372.—Gurjanova, 1951: 565, fig. 372.—Barnard & Karaman, 1991:

Material Examined: Eight specimens in two lots.
BRITISH COLUMBIA:
South-central mainland coast. ELB Stns., Jervis Inlet, May 12, 1977: Stn. J1 (off Queen's Beach), ooze and woody detritus, 360 m - 2 immature females; Stn. J2 (off Princess Royal Beach), mud, woody detritus, 576 m. - 2 immature females (to 4.5 mm) + 2 smaller specimens. CMN collections, Ottawa.

Diagnosis. Gurjanova (loc. cit.) partly described and figured mature female material (length to 12.0 mm). The rostrum is relatively long and nearly straight, and the anterior head lobe slightly upturned. The gnathopod propods are relatively slender, the carpal lobes very short. Peraeopods 3 & 4 are moderately fossorial, with distal segments setose, the dactyls large and thick. The hind margin of the telson is subtruncate and finely setose.

Present material from British Columbia is small, very immature, and was not examined in detail or illustrated.

Distributional ecology. Previously known only from the Chukchi Sea, at depths of 20-40 m. Here recorded from bathyal depths of a south-central mainland fiord of British Columbia having a shallow sill at its entrance.

Monoculodes packardi Boeck

Monoculodes packardi Boeck, 1871 per Gurjanova, 1951: 581. fig. 388.—Barnard & Karaman, 1991: 560.

Taxonomic and Distributional commentary. This species is dominant in coastal shelf waters of the North Atlantic, but in the North Pacific has been recorded only by Gurjanova (loc. cit.) from the Sea of Japan.

This eyed sublittoral species is most closely similar to the advanced group of eyeless bathyal species described by J. L. Barnard from submarine canyons off the coast of California. These include *M. necopinius, M. glyconicus,* and *M. sudor*, as listed above (p. 78) and keyed (p. 84). None was found in present material.

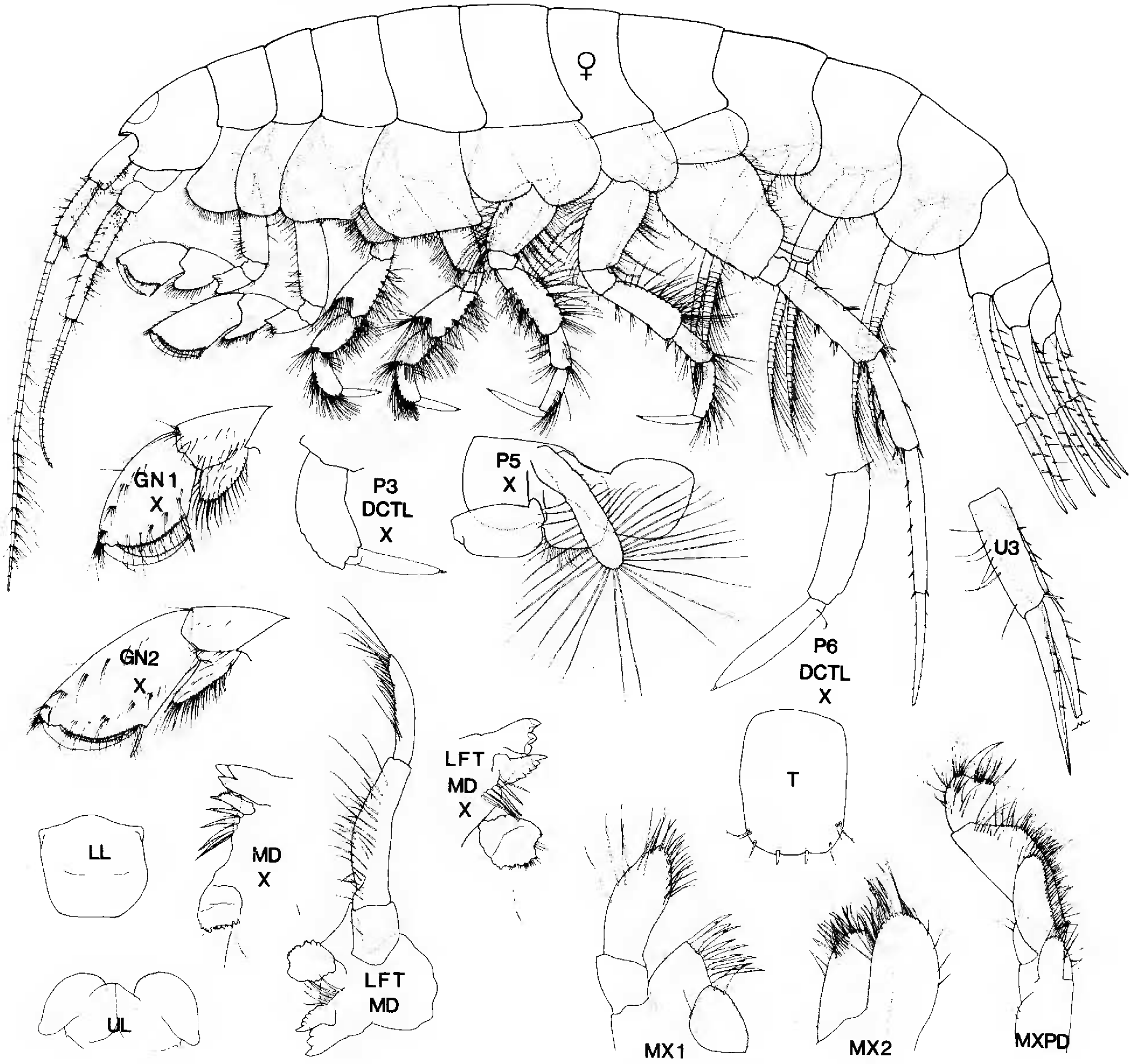

FIG. 7. *Monoculodes brevirostris,* new species. Off Bowen Island, B. C. Female (11.0 mm).

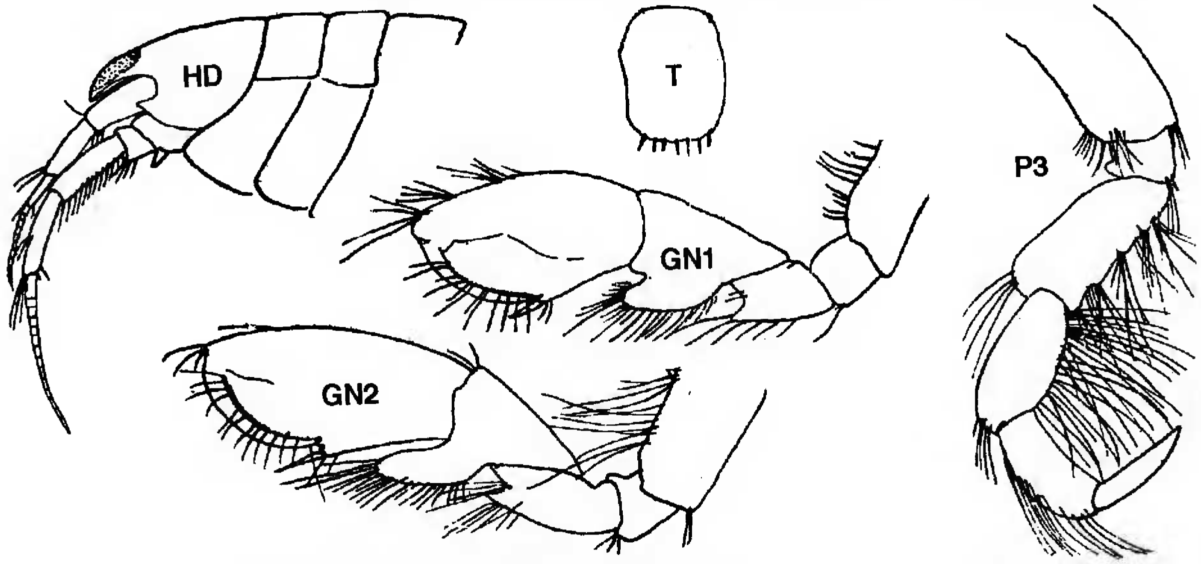

FIG. 8. *Monoculodes diamesus* Gurjanova. Chukchi Sea. Female (12.0 mm) (after Gurjanova, 1951).

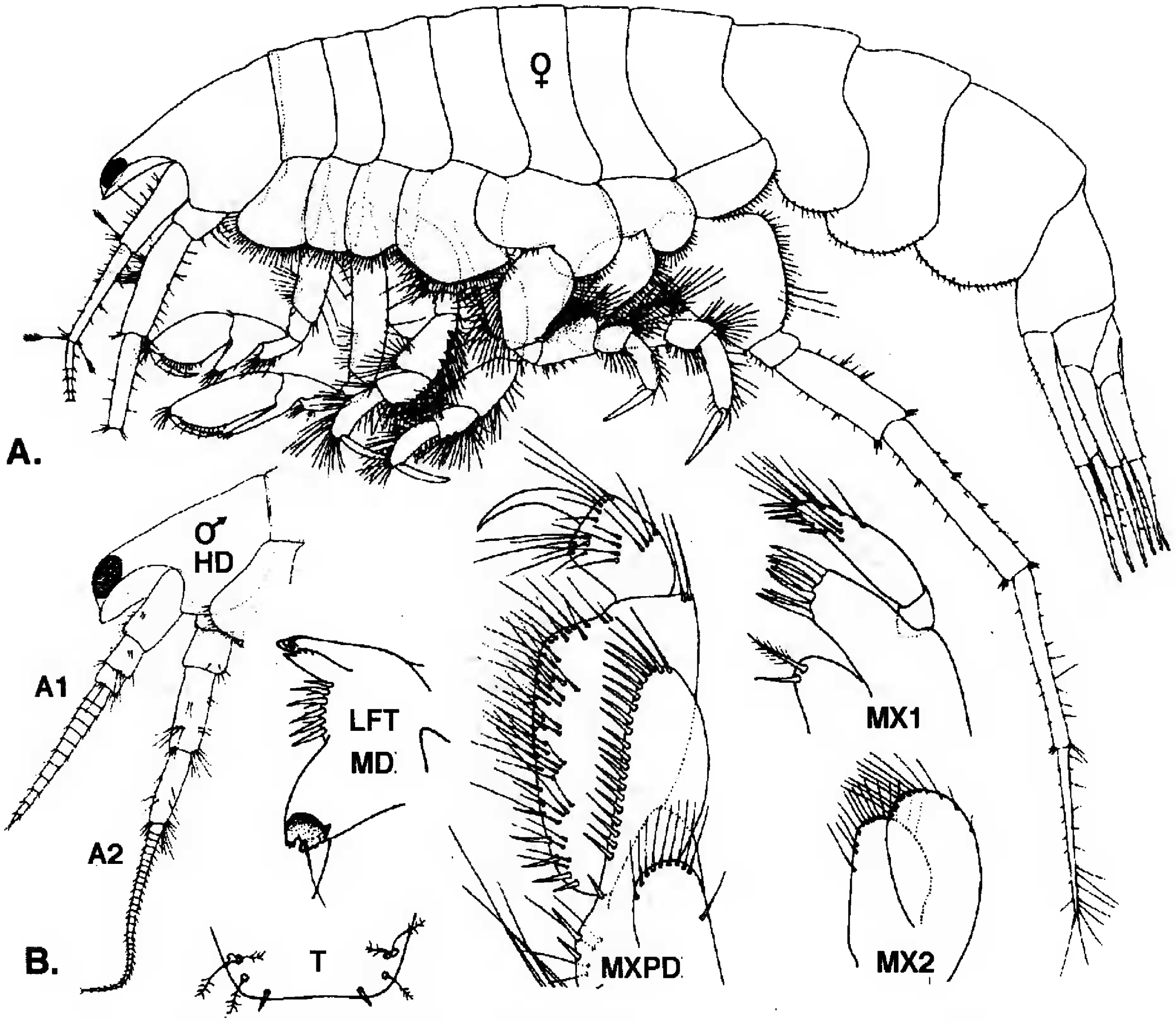

FIG. 9. ***Rostroculodes*** **species. Off Northeast Greenland. (after Just, 1980).**
A. ***Rostroculodes longirostris*** **(Goes). Female subadult (12.9 mm).**
B. ***Rostroculodes vibei*** **(Just). Male (10.6 mm), mouthparts, telson apex..**

Rostroculodes, new genus

Monoculodes Stimpson (part) Sars, 1895: 294.—Stebbing, 1906: 258. Gurjanova, 1951: 562.—Shoemaker, 1955:—Lincoln, 1979: 348.—Barnard & Karaman, 1991: 559. *Monoculodes longirostris* group Just, 1980: 30.

Type species. *Monoculodes longirostris* (Goes, 1865), present designation.

Species. *Rostroculodes hanseni* (Stebbing 1894); *R. kroyeri* (Sars, 1895); *R. schneideri* (Sars, 1895); *R. borealis* (Boeck, 1871); *R. vibei* (Just, 1980).

Diagnosis. Peraeon and pleon segments 2 & 3 smooth or weakly carinate mid-dorsally. Rostrum elongate,straight or slightly deflexed and bearing eyes apically or subapically. Antenna 1, peduncle slender, segment 2 distinctly longer than 1, segment 3 very short; flagellum weakly callynophorate in male. Antenna 2, flagellum elongate in male.

Mouthparts (based on *R. vibei* Just): molar slender, apex small, weakly triturative, rimmed by cutting teeth; spine row with slender blades; left lacinia 5-dentate, incisor weakly dentate; palp slender, segment 2 & 3 subequal in length. Maxilla 1, outer plate with 7 apical spines; palp slender, tapering distally. Maxilla 2, inner plate small. Maxilliped, inner plate short, apically setose; outer plate tall, narrow, inner margin strongly spinose; palp segment 2 broad, distal margin subtruncate.

Coxa 3, lower margin shallowly incised. Coxa 4, not broadened, lower margin angular. Gnathopods regular, not sexually dimorphic. Gnathopod 1, carpal lobe large; propod relatively small, little longer than carpus, deflexed distally. Gnathopod 2, basis medium to strongly setose anterodistally; carpal lobe medium strong, not reaching palmar angle; propod expanding and deflexed distally.

Peraeopods 3 & 4 fossorial; segment 4 distally broadened and setose; dactyl large, thick, tips with minute chitinous rings .Coxa 5 medium deep, postero-lobate. Peraeopods 5 & 6 fossorial, segment 4 broadened, setose; dactyls elongate, thick, chitinous rings very small. Peraeopod 7, basis regularly broadened, tapering distally, not incised behind, lacking lower lobe; dactyl elongate, margins setose.

Pleon plates 2 & 3, hind corners obtuse or rounded. Uropods 1 & 2 rami subequal. Uropods 3, outer ramus slightly the shorter. Telson medium, apex truncate or slightly emarginate, weakly armed.

Coxal gills not described.

Brood plates elongate, slightly broadening distally, margins strongly setose.

Taxonomic and distributional commentary. The genus *Rostroculodes* encompasses a group of high arctic species distinguished by the elongate rostrum and apically positioned eyes; antenna 1, peduncular segment 2 elongate; body dorsum slightly rugose, especially in the pleon.

Component species (e.g., *R. schneideri, R. longirostris* and *R. borealis*) have been recorded from sites marginal to the study region (e.g., Pt. Barrow, Alaska, per Shoemaker, 1955) but not yet from the eastern or western North Pacific proper and are not treated further here.

Hartmanodes, new genus

Monoculodes Stimpson (part)—Shoemaker, 1933: 9.—J. L. Barnard, 1962: 111, + key.—Barnard & Karaman, 1991: 559.

Type species. *Monoculodes hartmanae* J. L. Barnard, 1962: 363), present designation.

Species. *Hartmanodes murrius* (J. L. Barnard, 1962: 365); *H. nyei* (Shoemaker, 1933: 9).

Diagnosis. Peraeon and pleon segments 2 & 3 smooth. Rostrum large, apex strongly deflexed. Eyes nearly totally on rostrum, sexually dimorphic. Antennae short, sexually dimorphic. Antenna 1, very short, not attaining end of peduncle of antenna 2; peduncular segment 2 not longer than segment 1, segment 3 medium; flagellum callynophorate in male. Antenna 2, peduncular segment 5 >segment 4; flagellum elongate in male.

Mouthparts not described for any component species.

Coxa 1 little broadened distally. Coxae 2 & 3, lower margins oblique; coxa 3 shallowly incised below. Coxa 4, medium broad, little produced behind. Gnathopods 1 & 2 strongly differing in form and size, not sexually dimorphic. Gnathopod 1, meral process obsolescent; carpus narrow, posterior lobe medium large; propod long ovate, not deflexed distally. Gnathopod 2, basis moderately setose antero-distally; carpus narrow, hind lobe elongate, closely guarding propod, tip exceedingg palmar angle; propod elongate, slightly narrowing distally.

Coxa 5 large, deep, aequilobate. Coxa 6 medium deep. Peraeopods 3 & 4 fossorial, segment 4 distally broadened and setose; segment 5 >6; dactyls slender, medium short, tips with minute chitinous rings.

Peraeopods 5 & 6 fossorial, segment 4 broadened, setose; segment 5 < segment 6; dactyls slender, chitinous rings very small. Peraeopod 7, basis regularly broadened, narrowing distally, postero-distal lobe small, shallow; segment 5 not shorter than 4 & 6; margins of dactyl setose.

Pleon plates 2 & 3, hind corners sharply obtuse. Uropods 1 & 2, rami slightly unequal, shorter than peduncles. Uropod 3, ramis nearly unarmed, outer ramus slightly the shorter. Telson short, not narrowing distally, apical margin nearly straight, apex truncate or slightly emarginate, nearly bare.

Coxal gills large, rectangular.

Brood plates elongate, slightly broadening distally, margins strongly setose.

Etymology. The genus is a combining form, honoring the late Dr. Olga Hartman who contributed extensively to knowledge of the marine invertebrate benthos, particularly the Polychaeta of southern California.

Distributional commentary. The three known species of this genus occur in shallow coastal sands of warm-temperate and subtropical North America, from southern California and the Gulf of California to Florida. It has also been recorded from Brazil (Shoemaker, 1933). No species of the genus were taken in the the study region, and material has not been examined.

Taxonomic commentary. Barnard (loc. cit.) previously noted the strong similarity between these three species. Regrettably, he did not describe or figure the mouthparts of his two species. Shoemaker (loc. cit.) briefly referred to the

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KEY TO SPECIES OF *HARTMANODES*

1. Rostrum lacking ventral keel . . . . *H. murrius* (J.L.Barnard).

—Rostrum with ventral keel . . . . 2.

2. Gnathopod 2, propod elongate > 3X depth; telson weakly notched . . . *Hartmanodes nyei* (Shoemaker)

—Gnathopod 2 regular. length ~2X depth; telson gently convex behind . . *H. hartmannae* (J. L. Barnard)

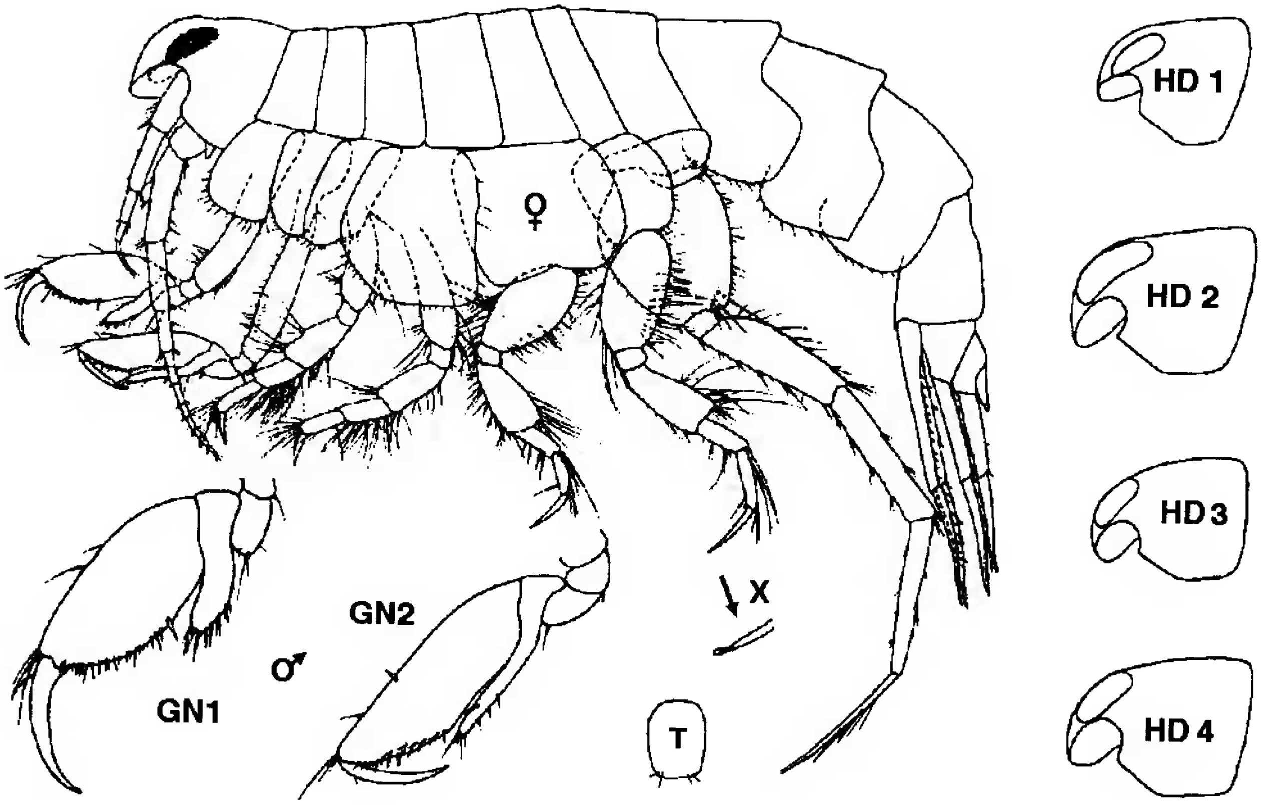

FIG. 10. ***Hartmanodes hartmanae*** **(J. L. Barnard). Off Southern California. Female (4.0 mm); male (3.0 mm). (after Barnard, 1962).**

mandibles and maxilliped but provided no illustrations of the mouthparts pf *H. nyei*.

The authors are reluctant to erect a new genus where some important taxonomic features are unknown and where type material has not been re-examined. However, all three species of the genus were described in legitimate fashion and, as a generic unit, can readily be keyed from all other oedicerotid genera (p. 80). The discovery of additional regional species is anticipated, at which time a full description of the mouthparts and other taxonomically important features would be recommend.

Ameroculodes, new genus

Monoculodes Stimpson, 1853 (part).—Holmes, 1905: 487.—Ledoyer, 1972: 767.—Bousfield, 1973: 95.—Barnard & Karaman, 1991: 559.

Type species. *Monoculodes edwardsi* Holmes, 1905 (present designation).

Species. *Ameroculodes* species (p. 94).

Diagnosis. Head, rostrum medium, not strongly deflexed distally. Eye on basal portion of rostrum. Antennae short, weakly sexually dimorphic, weakly callynophorate in male. Antenna 1, peduncular segment 1 stout, setose; segments 1 & 2 subequal in length; segment 3 large, length <1/2 segment 2; flagellum medium, exceeding peduncle of antenna 2. Antenna 2, peduncular segments 4 & 5 stout, setose; flagellum medium, length not greater than peduncle.

Mouthparts: Mandible, moral large, triturative; left lacinia 5-dentate; palp segment 2 short. Maxilla 1, outer plate with 9 apical spines; palp medium, setose distally. Maxilla 2, inner plate small. Maxilliped, inner plate short, apex with single spine and several setae; outer plate medium, outer margin smooth; palp segment 2 broad, distal margin subtruncate.

Coxa 1 broadened distally, hind margin with spine(s); coxae 2 & 3 relatively broad, spinose behind; coxa 4 large deep, produced posteriorly. Gnathopods 1 & 2 medium, dissimilar, weakly sexually dimorphic. Gnathopod 1, propod large, ovate, not distally deflexed, lower margin convex; carpus narrow, lobe large. Gnathopod 2, propod relatively short, little longer than in gnathopod 1, little narrowing distally; carpus narrow, hind lobe reaching palm.

Peraeopods 3 & 4, segment 4 strongly fossorial, setose; segment 5 > segment 6; segment 6 narrowing distally; dactyls minute. Coxa 5 very large, deep. Peraeopods 5 & 6 short, bases dissimilar; segment 4 strongly fossorial; segment 5 < segment 6; dactyls short, chitinous rings minute. Peraeopod 7, basis proximally broad, postero-distal lobe medium to large; segment 5 not longer than 4 & 6; dactyl elongate, hind margin setose.

Pleon plate 2, hind corner broadly squared or slightly produced, not rounded. Uropods 1- 3, rami unequal, not shorter than peduncles.

Telson medium, apical margin rounded, with 2 slender submedian setae.

Coxal gills large, sac-like, distally rounded. Brood plates slender, marginally and apically setose.

Distributional commentary. The two species of this genus, already referred to in the literature, are endemic to coastal waters of the North American Atlantic coast. Three additional undescribed species are known to one of us (ELB) from estuaries and brackish lagoons of the southeastern United States, from Chesapeake Bay to Florida.

Taxonomic commentary. *Ameroculodes* is distinguished from all other genera by the combination of very large coxal plates; very short dactyls of peraeopods 3-6; broad, truncate segment 2 of the maxilliped palp; and weak sexual dimorphism of the antennae and gnathopod 1.

Its closest affinities are apparently with the genus *Limnoculodes* (fig. 39, p. 138). Its two component species are endemic to fresh and brackish estuaries of warm-temperate and subtropical parts of the Asiatic coast of the North Pacific region, from Hong Kong north to southern Japan.

Ameroculodes edwardsi (Holmes)
(Fig. 11A).

Monoculodes edwardsi Holmes, 1905: 487.—Ledoyer, 1972: 769, figs. 3, 4.—Barnard & Karaman, 1991: 559-60 non *Monoculodes edwardsi* Holmes per Bousfield, 1973: 97,pl. XIX.1.

Taxonomic commentary. The species has been fully described and figured by Ledoyer (loc. cit.), based on material from the Gulf of St. Lawrence.

Ameroculodes species
(Fig. 11B)

Monoculodes sp. (=*M. edwardsi* Holmes, ident. Bousfield, 1973: 97, Pl. XIX.1).—Barnard & Karaman, 1991: 560.

Taxonomic commentary. Barnard & Karaman (loc. cit.) regard the species treated by Shoemaker (1930) and figured by Ledoyer (1972) as correctly assigned to *Monoculodes edwardsi* Holmes, 1905. The species from the Cape Cod region, described and figured under that name by Bousfield (1973), is considered formally undescribed and unnamed.

This study could provide an opportunity to correct this error. However, more pressing would seem the need to describe, simultaneously, the three other Atlantic species (above) for which illustrations have long been in publication-readiness. Such a comprehensive taxonomic study is to be treated in a separate work elsewhere (Bousfield, in prep.).

Kroyera Bate, revived status

Kroyera Bate, 1857: 140.—Bate, 1862: t. 17.
Monoculodes Stimpson 1853 (part).—Sars, 1895: 294.—Barnard & Karaman, 1991: 559.—Ledoyer, 1993: 589.—Ishimaru, 1994: 61.

Type species. *Kroyera carinata* Bate, 1857, by monotypy

Diagnosis. Body, especially pleon, mid-dorsally weakly carinated. Head, rostrum large, strongly deflexed distally; inferior head lobe rounded. Eye nearly totally on rostrum. Antennae short, weakly sexually dimorphic, Antenna 1 short, not reaching end of peduncle 5 of antenna 2, flagellum weakly callynophorate in male; peduncular segment 2 slender, length > segment 1; segment 3 short. Antenna 2, peduncular segment 5 >4; flagellum shorter than peduncle, somewhat elongate in male.

Lower lips broad. Mandible, molar large, triturative; left lacinia 5-dentate; palp slender, segment 3 shorter than segment 2. Maxilla 1, outer plate with 9 apical spines; palp slender, lacking distal setae. Maxilla 2, plates narrow. Maxilliped, inner plate short, apex setose; outer plate slender, outer distal margin setose; palp segment 2 broadening to truncate distal margin; segments 3 & 4 small.

Coxa 1 rounded distally, hind margin with spine(s); coxae 2 & 3 narrow, lower margins oblique; coxa 4 medium, little produced posteriorly. Gnathopods 1 & 2 medium, strongly dissimilar, not sexually dimorphic. Gnathopod 1, propod subovate, slightly distally deflexed; meral process obsolescent; carpus medium, hind lobe large. Gnathopod 2, propod elongate, not narrowing distally; carpus narrow, hind lobe reaching palmar angle.

Peraeopods 3 & 4, segment 4 strongly fossorial, setose; segment 5 <segment 6; segment 6 linear; dactyls minute. Coxa 5 medium large. Peraeopods 5 & 6 differing in length; segment 4 medium, fossorial; segment 5 subequal to segment 6; dactyls very small, chitinous rings not visible. Peraeopod 7, basis regular, postero-distal lobe small; segment 5 longer than 4; dactyl elongate, margins weakly spinose.

Pleon plate 2 broadly rounded behind. Uropods 1- 3, rami and peduncles subequal.

Telson short, apical margin truncate, setae minute.

Coxal gills elongate, sac-like, distally rounded. Brood plates very slender, marginally and apically setose.

Distributional commentary. The monotypic genus is endemic to the European Atlantic and Mediterranean regions. The population in Japanese waters, records of which are summarized by Ishimaru (1994), may prove to be a different species. The record from British Columbia (Wailes, 1931) is considered doubtful (below).

Taxonomic commentary. *Kroyera* is unlike all other genera in its combination of: carinated pleon, minute peraeopod dactyls, short segment 5 of peraeopods 3 & 4, small basis of peraeopod 7, and unique form of the maxillipeds.

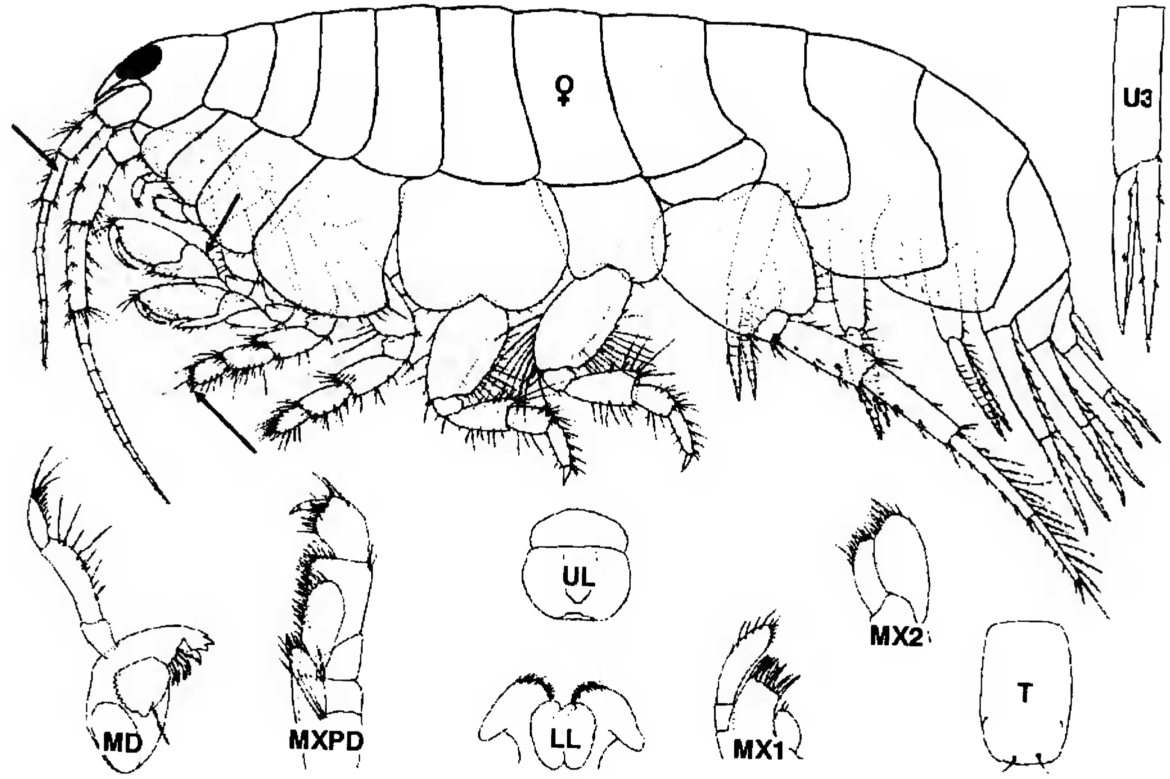

FIG. 11B . *Ameroculodes* species. Cape Cod Region. Female (9.0 mm) (after Bousfield, 1973).

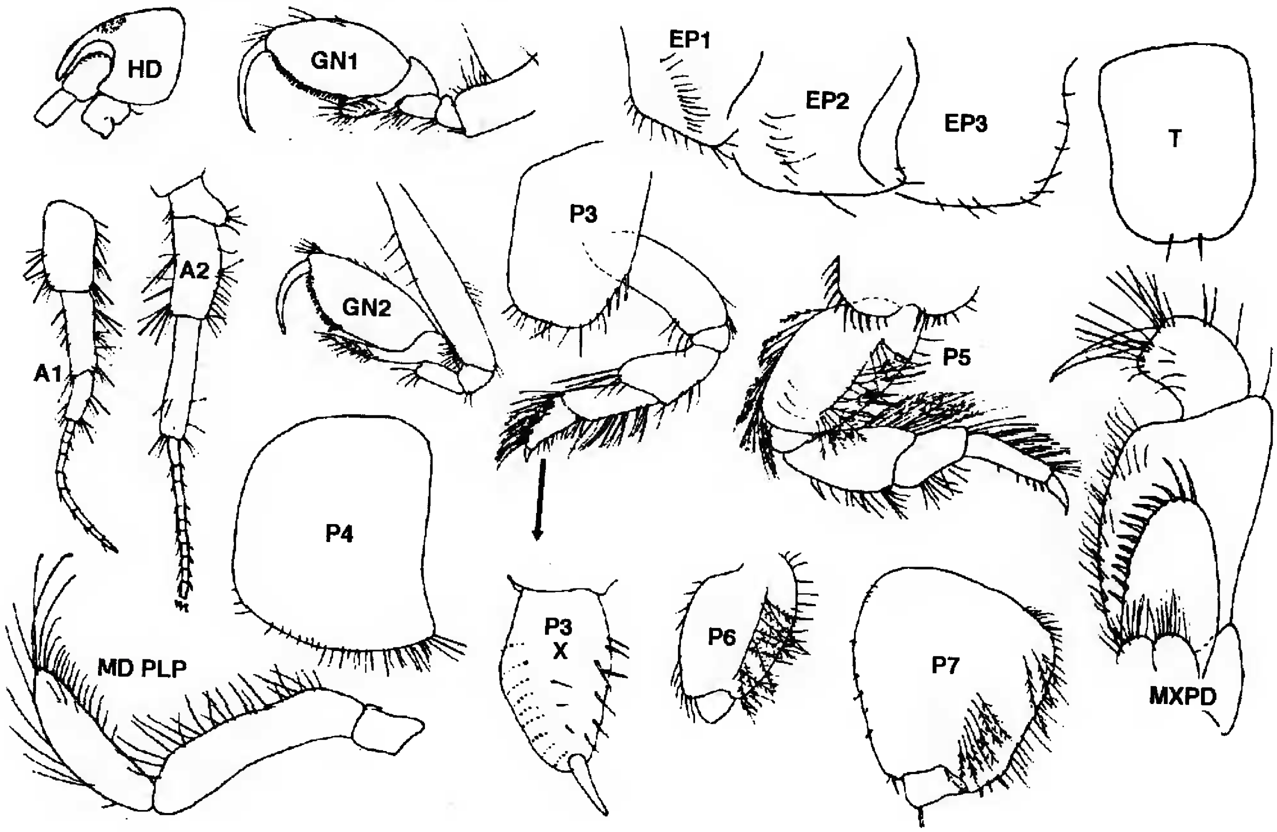

FIG. 11A. *Ameroculodes edwardsi* (Holmes). Chaleur Bay. Female (8.0 mm?) (after Ledoyer, 1972).

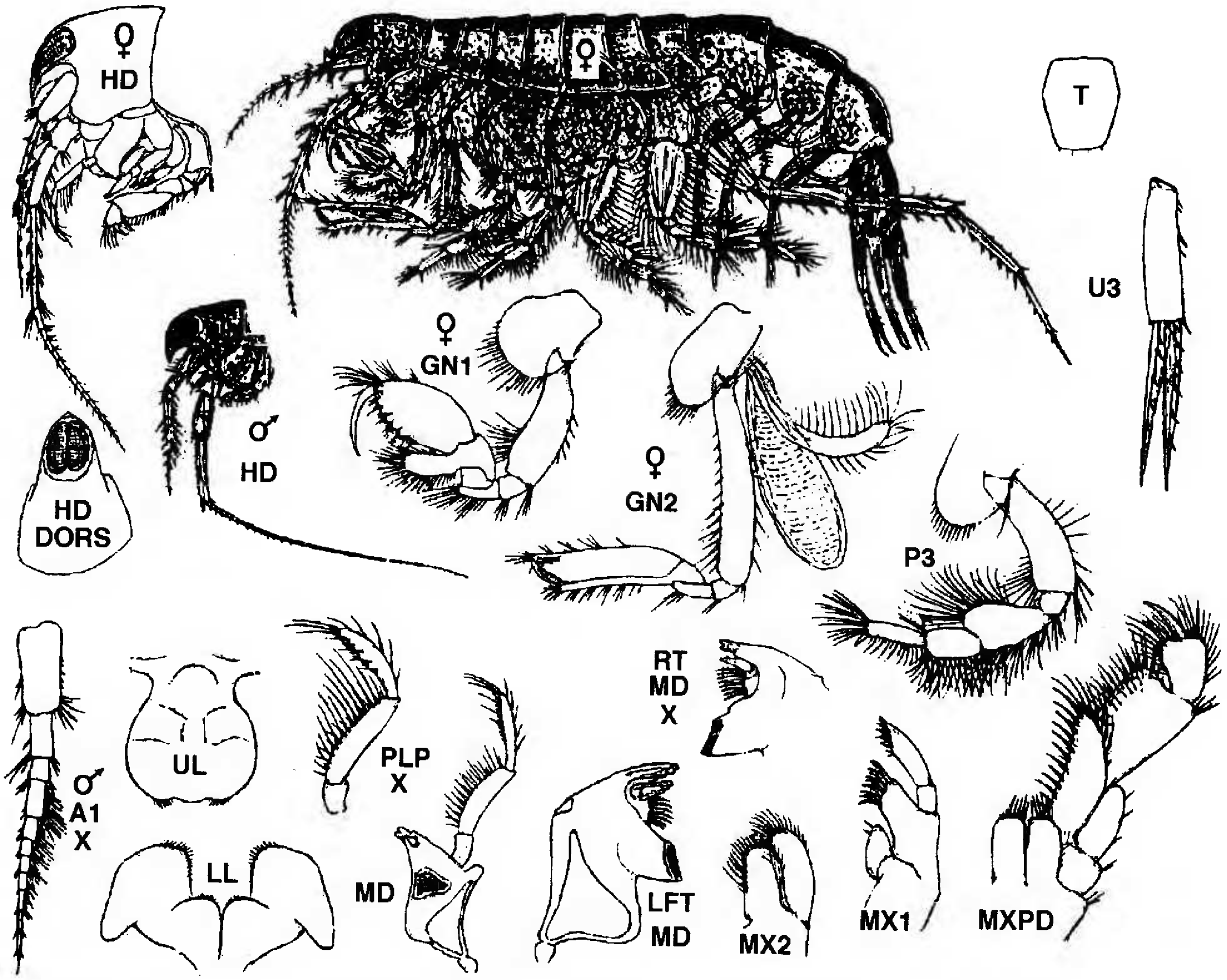

FIG. 12. *Kroyera carinata* Bate. European Atlantic coast. Female (10.0mm); male (8.5 mm). (after G. O. Sars, 1895).

The form of the peraeopods and coxal plates suggests a natural affinity with the genus *Deflexilodes* (fig. 13, p. 99) but *Kroyera* exhibits far more advanced character states. The genus appears convergently similar to *Pacifoculodes* but differs in the large deflexed rostrum, form of the maxillipeds, the small, narrow coxae 1-4, and the differing relative sizes of segments 5 & 6 of peraeopods 3 & 4.

The present decision to revive the genus *Kroyera* is based partly on the original contention of Bate (1862) who noted major taxonomic differences between the N. American Atlantic *M. demissus* Stimpson 1853 and his European Atlantic species, *Kroyera carinata* Bate, 1857. An earlier generic name *Westwoodea*, based on *Westwoodea carinata* Bate, 1856, is considered a nomen nudum by Stebbing, 1906. As noted above (p.78), in rediagnosing the genus *Monoculodes* Stimpson, Barnard & Karaman (loc. cit.) by-passed Stimpson's North American Atlantic type species, *M. demissus*, and selected *"Monoculodes" carinatus* Bate, 1856, as an effective neotype species. This action was apparently predicated on the first use of the name *Monoculodes* for which diagnostically acceptable information was provided. In our view, however, Stimpson's diagnosis, although weak and incomplete, does name a type species, with type locality, and is sufficiently detailed to exclude *M. carinatus* on several generically significant features (above & key, p. 80). Moreover, *Kroyera carinatus* is apparently restricted to the eastern North Atlantic, Mediterranean, and western North Pacific regions.

Kroyera carinata Bate
(Fig. 12)

Kroyera carinata Bate, 1857: 140.
Monoculodes carinatus (Bate, 1857).—Sars, 1895: 295, pl. 105.—Stebbing, 1906: 261.—Lincoln, 1979: 348, fig. 164.—Barnard & Karaman, 1991: 559.—Ledoyer, 1993: 589, fig. 404.—Ishimaru, 1994: 61.
Monoculodes carinatus (Bate)?—Wailes, 1931: 41.—Austin, 1985: 591.

Taxonomic and distributional commentary. *Kroyera carinata* is an advanced member of the *Monoculodes* generic complex in which the propod of gnathopod 2 is elongate, and the peraeopods are strongly fossorial. Diagnosis with the characters of the genus

Although Wailes' record of *"Monoculodes" carinatus* (Bate) from British Columbia, repeated by Austin (1985), is possibly correct, it is here treated with reservation. His original material is not available for re-examination. No carinated material of the *Monoculodes* complex was found among the several thousand regional specimens of the present study.

Deflexilodes, new genus

Monoculodes Stimpson (part) Stebbing, 1906: 258.—Gurjanova, 1951: 562.—Barnard, 1969a: 383.—Bousfield, 1973: 95.—Lincoln, 1979: 348.—Barnard & Karaman, 1991: 559.—Ledoyer, 1993: 587.

Type species. *Monoculodes tenuirostratus* Boeck, 1871, present designation.

Species: *Deflexilodes intermedius* (Shoemaker, 1930); *D. norvegicus* (Boeck, 1971); *D. tuberculatus* (Boeck, 1871); D. *tesselatus* (Schneider 1884); *D. minutus* (Gurjanova, 1929); *D. rostratus* (Stephensen, 1931)? *D. simplex* (Hansen, 1888); *D. subnudus* (Norman, 1889); *D. similis*, new species (p. 97); *D. gibbosus* (Chevreux 1888); *D. griseus* (Delle Valle, 1893); *D. acutipes* (Ledoyer, 1983; *D. enigmaticus,* new species (p. 99); *D. uncinatus* Bulycheva, 1952). (15 spp.).

Diagnosis. Head, rostrum large, apex variously deflexed. Body, especially pleon segments, smooth or weakly carinated mid-dorsally. Eyes sexually dimorphic, usually partly basal on head. Antennae various, usually slender, sexually dimorphic. Antenna 1 (female) longer than peduncle of antenna 2.

Lower lip broad, inner lobes distinct. Mandible, molar triturative; palp, inner margin of segment 2 with stout setae of irregular length; segment 3 relatively short. Maxilla 1, outer plate with 9 apical spines. Maxilla 2, inner plate broader than outer. Maxilliped, inner plate with apical spine(s) and setae; outer plate medium, broad, narrowed basally; palp segment 2 broadened, distal margin oblique.

Coxal plates normal, deep. Coxa 1 not expanded. Gnathopod 1, carpus long, lower lobe short, not reaching palmar angle; propod distally deflexed, lower margin concave. Gnathopod 2, basis elongate; carpus medium, posterior lobe medium, not closely guarding propod nor exceeding palmar angle; propod broadening distally, spine at postero-distal angle not elongate.

Coxa 4 broadened postero-distally. Peraeopods 3 & 4 weakly to moderately fossorial (segments stout, setose); segment 5 <6; dactyls longer than segment 6, chitinous rings usually small. Coxa 5 deep, aequilobate. Coxa 6 regularly postero-lobate. Peraeopods 5 & 6 subsimilar; segment 5 < 6; dactyls slender, <segment 6, chitinous rings distinct. Peraeopod 7, basis not greatly broadened proximally, hind lobe small or lacking.

Pleon plates 2 & 3 rounded or broadly obtuse behind. Uropods 1 & 3, rami variously unequal, longer than peduncles; Telson short, apical margin straight or convex, with 4 small spines and/or setae.

Etymology: A combining form of the Latin root "deflectere" - to bend or turn aside, and the suffix "-odes", with reference to the distally deflexed form of the propod of gnathopod 1.

Taxonomic and distributional commentary. The 15+ species of this second largest monoculodid subgroup are centred on the North Atlantic, with outliers in the Arctic and North Pacific regions.

Deflexilodes norvegicus (Boeck)

Monoculodes norvegicus (Boeck) Sars 1895: 301, pl. 107, fig. 1.—Barnard, 1962: 367.—Barnard, 1966: 77.—Barnard & Karaman, 1991: 560.

Material Examined. None from the study region.

Taxonomic and distributional commentary. Barnard (1962) dredged this species widely and abundantly in *Amphipodia-Onuphis* ophiuroid communities at depths of 22-180 m. on the coastal shelf of southern California. Comparing his material with that from northwestern Europe illustrated by Sars (loc. cit.), Barnard noted differences in segment 6 and dactyls of peraeopods 3 & 4 that he suggested might be worthy of new subspecific designation. The Californian material thus awaits full redescription and illustration.

Deflexilodes similis, new species
(Fig. 13)

Monoculodes tuberculatus Boeck (part)?—Gurjanova, 1951: 580.—Barnard & Karaman, 1991: 560.

Material Examined. About 90 specimens, in 14 lots, ranging from Rat I. (Amchitka), south to central and southern B. C.

ALASKA:

Aleutian Islands, Rat I., C. E. O'Clair coll., 1969 - 2 immatures CMN cat no.NMCC1990-0459; Ibid, - female ov (9.0 mm) **Holotype**; male (7.0 mm), **Allotype**; 30 males, 6 imatures, **Paratypes**. CMN cat. no. NMCC1990-0460.

BRITISH COLUMBIA:

North-central coast. ELB Stns., July,1964: H25 - 4 males, 1 female, 16 immatures (males to 7.0 m; females to 5.5 mm); H34 - 1 immature; H55 - 1 immature.

Swanson Bay, C. Levings Stn. L., 1973 - 1 male.

South-central coast. ELB Stns., Jervis Inlet, May, 1977: E2 - 1 male; E3 - 4 immatures. Burrard Inlet, ELB Stn. P3 (1 km south West Bay), mud and woody detritus, 60 m., Nov. 2, 1977 - 1 male.

Vancouver I., south end. ELB Stns. 1975: P25 - 1 female; P26 (Ives Inlet) - 3 males, 2 female, 9 immatures.

G.W.O'Connell Stn., off Clover Pt.,Victoria, Aug., 1976 - 1

KEY TO NORTH PACIFIC SPECIES OF *DEFLEXILODES*

(includes North Atlantic speccies *D. intermedius* (Shoem.) and *D. tenuirostratus* (Boeck)

1. Coxae 1-4 narrow; peraeopod 7, basis broad , depth ~ length .... 2.
—Coxae 1-4 broad; peraeopod 7, basis narrow, depth > length .... 4.

2. Rostrum slender, nearly straight, not deflexed distally; antennae elongate; telson, apically narrowing, rounded .... *D. tenuirostratus* (Boeck)
—Rostrum stout, slightly deflexed apically; antenna short; telson , apex broad, slightly incised ...... 3.

3. Gnathopod 2, propod regular, length ~2X depth; antenna 1, peduncular segment 2 .with antero-distal process or tubercle.. *D. tuberculatus* (Boeck)
—Gnathopod 2, propod elongate, length ~2.5 X width; antenna 1, segment 2 with antero-distal process or tubercle.. *D. norvegicus* (Boeck) (p. 97)

4. Telson elongate, narrowing distally .... *D. intermedius* (Shoemaker)
—Telson short-rectangular, distally broad .... 5.

5. Coxa 5 broader than deep; peraeopods 5 & 6, dactyls long, >segment 6 .. .. 6.
—Coxa 5 deeper than broad; peraeopods 5 & 6 relatively short, length <segment 6.................. .... *D. similis*, n. sp. (p. 97)

6.Rostrum short <1/2 head length; gnathopod 2, propod margins subparallel. *D. enigmaticus*, n. sp. (p. 99)
—Rostrum long >1/2 head length; gnathopod 2, propod broadening distally . *D. uncinatus* (Buly.) (p.101)

male, 2 immatures; Nanoose Bay, J.F.L.Hart coll., 1933 - 1 male. CMN collections, Ottawa.

(

Diagnosis. Female (7.0 mm). Body, including pleon, dorsally smooth. Head, rostrum strong, slightly deflexed distally; anterior head lobe acute. Eye large, partly on rostrum. Antenna 1, peduncular segment 2 shorter than 1, antero-distal process weak; segment 3 ~1/2 segment 2; flagellum medium, 7-10 segmented, exceeding peduncle of antenna 2. Antenna 2, peduncular segments 4 & 5 subequal; flagellum ~12-segmented, shorter than peduncle.

Lower lip medium broad. Mandible: molar reduced, weakly triturative; spine row with 6 slender blades; palp large, segment 3 long, arched, inner margin strongly setose. Maxilla 1, palp slender, outer distal margin of segment 2 weakly setose. Maxilliped, inner plate very short, apical margin with long stiff setae; outer plate medium, outer margin convex; palp segment 2 moderately broadened distally.

Coxa 1-4, lower margins strongly setose. Coxa 1 little broadened distally, hind margin with short spines. Coxa 3 much broader than 2 ; coxa 4 as broad as deep, little produced behind. Gnathopod 1, basis, margins distally setose; meral process short; carpus longer than deep, hind lobe medium, barely attaining postero-distal angle of palm; propod relative small, slender, very slightly deflexed distally. Gnathopod 2, basal margins distally setose; carpus short, hind lobe slender, apex attaining postero-distal angle; propod slender slightly broadening distally, length ~2.5 X depth.

Peraeopods 3 & 4, bases strongly setose antero-distally; segment 4 weakly fossorial; segment 6 sublinear, setose posteriorly and antero-distally; dactyl slender, subequal in length to segment 6, tips with minute chitinous rings.

Coxa 5 broad, medium deep, aequilobate. Coxa 6 medium; both coxae strongly setose below. Peraeopod 6 distinctly larger than 6; segment 4, margins strongly setose; dactyls very slender, subequal in length to linear segment 6. Peraeopod 7, basis medium broad, hind margin slightly incised, postero-distal lobe weak; segment 5 >segment 4.

Pleon plate 2, hind margin obtusely rounding, finely setose throughout. Uropods 1 & 2, outer ramus the shorter, margins nearly bare; uropod 3, subequal rami longer than peduncle.

Telson subrectangular, apical margin gently convex, weakly emarginate, with pair of short setae medially and disto-laterally.

Coxal gills sac-like, broadening distally. Brood plates strap-like, slightly broadening distally, distal margin long-setose.

Male: (6.0 mm). Antenna 1, flagellum, basal segments 12-segmented,basally conjoint but not callynophorate. Antenna 2 elongate; peduncular segment 5 slightly longer than 5, both with anterior marginal brush setae.

Etymology. From the Latin "*similis*" - like, and the root name "*tuberculatus*", with reference to the close similarity of this species to *Deflexilodes tuberculatus* Boeck, 1871.

Distributional ecology. Bering Sea to southern British Columbia,subtidally on coarse sand to silty sand bottoms, at depths of 12 - 30+ m.

Taxonomic commentary. *Deflexilodes similis* is closely related to *D. tuberculatus* Boeck from western European waters and recorded by Gurjanopva (loc. cit.) from the

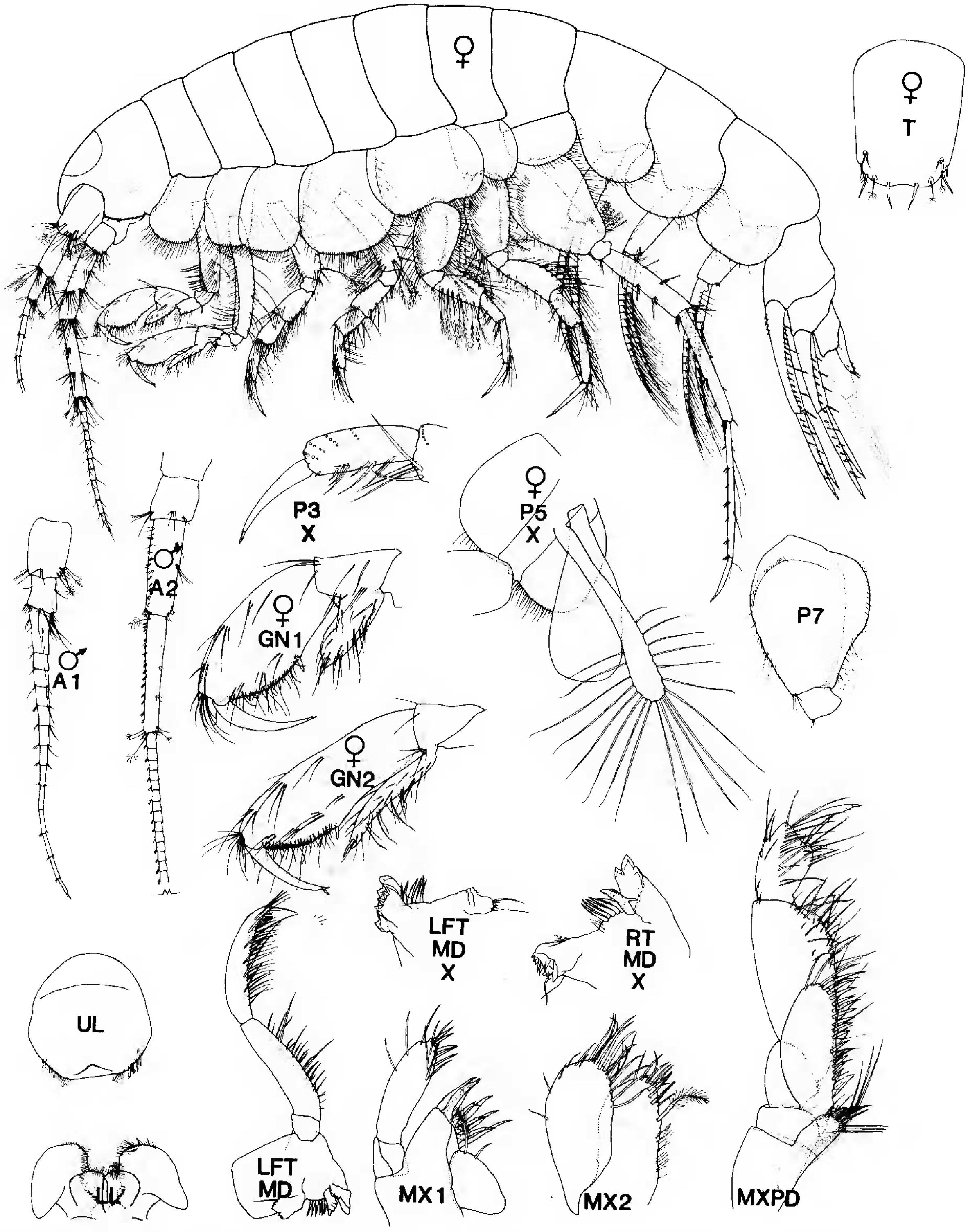

FIG. 13. ***Deflexilodes similis*****, new species. Rat. I., Alaska. Female (9.0 mm); male (6.0 mm).**

ELB Stns., July, 1980: S1F1 (Leo Anchorage), stones & kelp, 6-10 m. - 1 female (6.0 mm), **Holotype**, 1 male (4.0 mm), **Allotype**. CMN Collections, Ottawa.

Deflexilodes enigmaticus, new species
(Fig. 14)

Material Examined.

ALASKA:

Southeastern Alaska. ELB Stns., 1961: A84 (1 female); A115 (1 male, 4 females, 4 immatures, CMN cat. no. NMCC1990-1162.

BRITISH COLUMBIA:

South-central coast. ELB Stns., English Bay, June, 1976: EB7, muddy sand, 26 m. - 1 male, 2 females, 3 immatures; EB8, mud, 40 m - 2 males; 3 females, 5 immatures; ELB

Stns., Nov., 1977: P01, 44-50 m - 2 specimens.
ELB Stns., 1978: ELB Stn. V4 (Burrard Inlet), sandy mud, shell, 50 m. - 2 males, 4 females, 9 immatures.
Vancouver Island, north end, ELB Stns., 1975: P21a (Gooding Cove), coarse sand, 12-14 m. - 2 females, 1 immature; P21b, sand, 8 m. - 1 male, 2 females, 6 immatures; P21c, fine sand, 8 m. - 2 males, 14 females, 3 immatures. [slide mounts of female (8.0 mm), male (4.0 mm)].
Vancouver I., south end. ELB Stns., May, 1977: B3 (Departure Bay), mud & woody debris, 17-33 m - 4 specimens.

Diagnosis. Female (6.0 mm). Body dorsally smooth. Head, rostrum very strong, deflexed distally; anterior head lobe subacute. Eye large, mainly on rostrum. Antenna 1, peduncular segment 2 shorter than 1, lacking antero-distal process; segment 3 short, ~1/3 segment 2; flagellum medium, ~10 segmented, slightly exceeding peduncle of antenna 2. Antenna 2, peduncular segments 4 & 5 subequal; flagellum not longer than peduncle.

Lower lip broad, shallow. Mandible: molar reduced, weakly triturative; spine row with 5-6 slender blades; palp medium large, segment 3 somewhat shorter than segment 2. Maxilla 1, palp medium, outer distal margin of segment 2 weakly setose. Maxilliped, inner plate very short, apical margin with short spine and stiff setae; outer plate medium, outer margin strongly convex; palp segment 2 stout, distal margin oblique.

Coxa 1-4 successively increasing in size, lower margins gently convex, moderately setose. Coxa 1 little broadened distally, hind margin nearly bare. Coxa 4 broader than deep, produced behind. Gnathopod 1, basis, margins distally setose; meral process short, acute; carpus longer than deep, hind lobe short, broad, not attaining postero-distal angle of palm; propod relative short, deep, deflexed distally. Gnathopod 2, basis, antero-distal margin setose; carpus short, hind lobe slender, apex with stout spine, attaining postero-distal angle; propod slender slightly broadening distally, length ~2.5 X depth.

Peraeopods 3 & 4, setose antero-distally; segment 4 moderately strongly fossorial (broadened and setose distally); segment 6 slightly arched, strongly setose behind and antero-distally; dactyls slender, much longer than segment 6, tips lacking chitinous rings.

Coxa 5 broad, medium deep, aequilobate. Coxa 6 medium; both coxae strongly setose below. Peraeopods 6 and 6 subsimilar; segment 4 medium stout, margins strongly setose; dactyls very slender, longer that respective segment 6. Peraeopod 7, basis not strongly broadened proximally, hind margin straight, postero-distal lobe small; segment 5 not longer than segment 4.

Pleon plate 2, hind margin broadly rounding, nearly bare throughout. Uropods 1 & 2, rami closely subequal, shorter than peduncles, margins moderately spinose; uropod 3 not present.

Telson short-rectangular, apical margin slightly emarginate, with pair of widely spaced short spines and disto-lateral short setae.

Coxal gills sac-like, rounded distally. Brood plates broadly strap-like, distally with long marginal setae.

Male: (4.0 mm). Rostrum less strongly deflexed. Eye much larger. Antenna 2 elongate; peduncular segment 4 not longer than 5, both with weak anterior marginal brush setae.

Etymology. From the Latin "*enigma*" - puzzling, with reference to the unexpected occurrence of a species that is very similar to a species described originally from the Atlantic coast of North America.

Distributional ecology. Southeastern Alaska to southern British Columbia, subtidally on coarse sand to silty sand, at depths of 6-50 m.

Taxonomic commentary. In nearly all major character states, *Deflexilodes enigmaticus* is closely similar to *D. intermedius* (Shoemaker, 1930), from the the northeastern American Atlantic region (per Bousfield, 1973; Watling, 1981). However, *D. enigmaticus* differs in characters of the key and in addition, the maxilliped outer plate is distinctly broader, the propod of gnathopod 2 is less elongate, the propods and dactyl of peraeopod 7 is less setose, and the telson is somewhat shorter and broader than in *D. intermedius*.

Some variation in the form of the rostrum, relative size of peduncular segment 2 of antenna 1, and in body size of mature specimens throughout the present study range has been noted. Pending further analysis, however, the variations are not considered of species level significance.

Deflexilodes uncinatus (Bulycheva)
(Fig. 15)

Monoculodes uncinatus Bulycheva, 1952: 210, fig. 12.—Barnard & Karaman, 1991: 560.

Diagnosis. Male (7-8 mm): Rostrum relatively short, < 1/2 total head length, apex moderately deflexed. Antenna 1, flagellum 10-segmented. Antenna 2, pedunc. segment 5 > 4.

Coxa 1 little broadened distally; coxa 2 with 3-4 hind marginal spines. Gnathopod 1, basis, anterior margin with with strong median setae; propod short, broad. Gnathopd 2, propod broadening distally, lower margin gently convex.

Peraeopods 3-6 moderately fossorial, setose; dactyls elongate, >> segment 6, tips with small but distinct chitinous rings. Peraeopod 7, basis not broadly expanded.

Telson subrectangular, apex very slightly emarginate.

Taxonomic and distributional commentary. *Deflexilodes uncinatus* has been recorded from Peter-the-Great Bay, northern Sea of Japan, subtidally at depths of 28-71 m. Morphologically, it appears closest to *D. enigmaticus*, the most northerly species of the North American Pacific coast (see key, p. 99). However, the mouthparts, uropods, and other diagnostic characters, as well as the female, await more complete description.

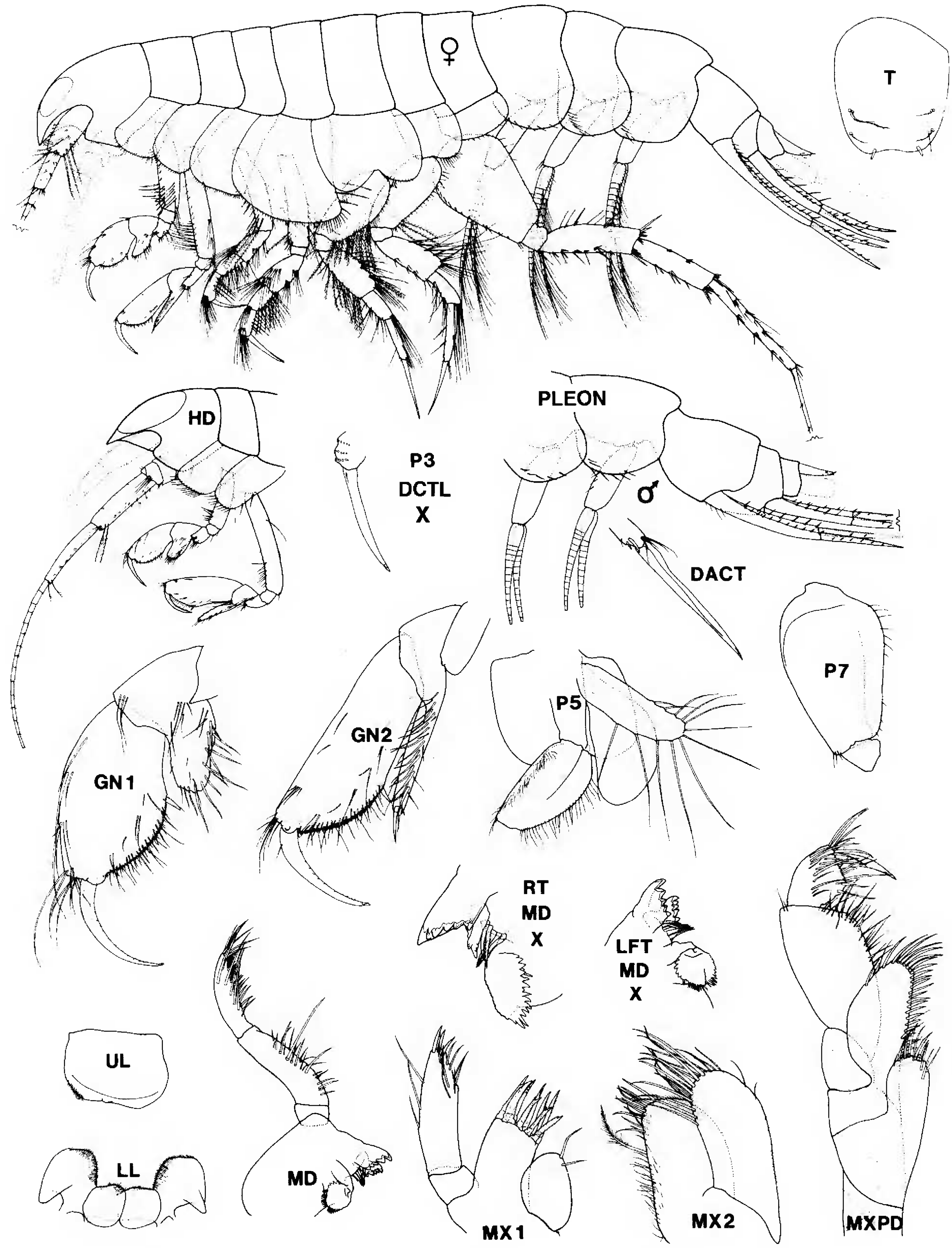

FIG. 14. *Deflexilodes enigmaticus,* new species. Leo Anchorage, Southeastern Alaska. Female (6.0 mm); male 4.0 mm)

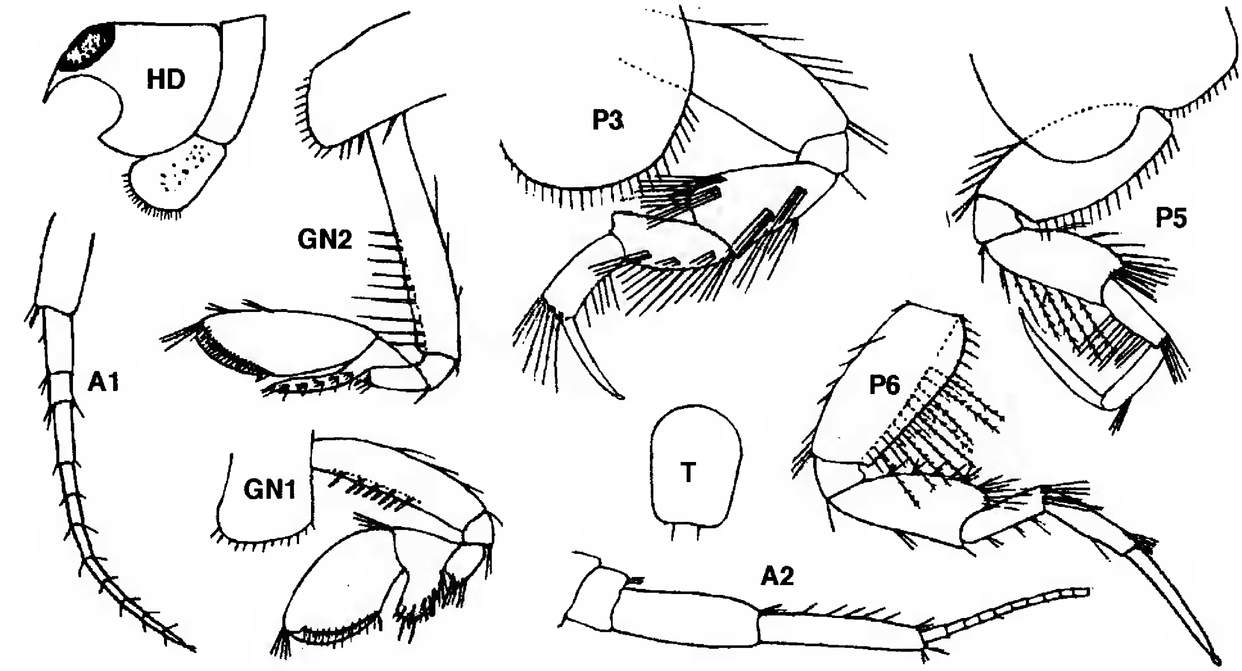

FIG. 15. *Deflexilodes uncinatus* (Bulycheva). Peter-the-Great Bay, 28-71 m. Male (7-8 mm). (after Bulycheva, 1952).

Pacifoculodes, new genus

non *Monoculodes* Stimpson, 1853: 41.
Monoculodes Stimpson (part) Gurjanova, 1951: 566.—Bulycheva, 1952: 209.—Mills, 1962: 9.—Barnard, 1962: 356(+key).—Barnard, 1969a: 383.—Ledoyer, 1972: 767.—Barnard & Karaman, 1991: 559.

Type species. *Monoculodes spinipes* Mills, 1962: 12, present selection.

Species. *Pacifoculodes zernovi* (Gurjanova, 1938); *P. nasutus* (Bulycheva, 1952); *P. breviops* (Bulycheva, 1952); *P. levingsi*, new species; *P. barnardi*, new species; *P. levingsi*, new species; *P. crassicornis* (Hansen (per Gurjanova, 1951, but not Ledoyer, 1972)); *P. pallidus* (Sars, 1895); *P. dembiensis* (Bulycheva, 1952); *P. synophthalmus* (Bulycheva, 1952); *P. bruneli*, new species. (12 spp.).

Diagnosis. Medium to large monoculodids, characterized by: head, rostrum regular, usually not strongly deflexed; fused eyes partly or wholly on rostrum; anterior head lobe acute or sharply rounded, inferior margin oblique. Body smooth above, often maculated in colour. Antenna 1 short to medium; peduncular segment 2 subequal to segment 1; segment 3 not elongate. Antenna 2 longer than antenna 1; peduncular segment 4 & 5 setose.

Lower lip broad, inner lobes separated. Mandible, molar with triturative apex; spine row with 4-6 blades; incisor toothed; left lacinia 5-7 dentate, right lacinia irregularly bifid; palp segment 3 variously shorter than segment 2. Maxilla 1, outer plate with 9 apical spine teeth; palp segment 2 stout, setose. Maxilla 2, outer plate not broadened. Maxilliped; inner plate apically setose; outer plate tall, outer margin convex, inner strongly masticatory; palp segment 2 broad, distally subtruncate.

Coxa 1 distally broadest, lower margin strongly setose. Coxa 2 narrow, lower margin variously oblique, hind margin with longish spines. Coxa 3 regularly deep, rounded below, hind margin spinose. Gnathopods not sexually dimorphic. Gnathopod 1, basis antero-distally setose; propod large, longer than deep, hind margin short; carpus, anterior margin medium to narrow, posterior lobe large, extending beyond palmar angle. Gnathopod 2, basis elongate, antero-distally setose; propod elongate ~2-4 X maximum depth, often narrowing distally; palm oblique; carpus, anterior margin narrow; postero-distal lobe slender, elongate, usually closely guarding propod throughout.

Coxae 4 broadened distally, hind corner acute, produced. Peraeopods 3 & 4, segments 4-6 strongly setose; segment 5 longer than 6; dactyls slender, much shorter than, and overhung anterodistally by segment 6. Coxa 5 deep, weakly posterolobate. Coxa 6 mediumdeep. Peraeopods 5 & 6, segment 4 stout, broadest distally; segment 5 shorter than 6; dactyls short to medium, not (or little) longer than segment 6. Peraeopod 7 large, elongate, basis very broad proximally, hind margin convex, narrowing distally to distinct lower hind lobe; segments 4-7, margins spinose.

Pleon plate 2, hind corner quadrate to acutely produced; plate 3 rounded behind. Pleopods regular. Uropod 1, outer ramus often the shorter Uropod 3 large, rami strong, margins spinose. Telson, apical margin straight or slightly incised, with 2 pairs of unequal setae.

Coxal gills large, sac-like. Brood plates setose marginally and apically.

Etymology: A combining form of the geographical name "Pacific-" and the suffix "*-oculodes*", with reference to the mainly North Pacific-endemic occurrence of component species.

Distributional Ecology. Component species occur in shallow shelf waters of the North Pacific region, mainly on clean surf-exposed sands, from the shoreline to 50 m. .deep

Taxonomic Commentary. This genus differences from the type genus *Monoculodes* in characters of the key, and in addition: *Pacifoculodes* is an advanced member of the *Moncoulodes* complex in virtually all character states considered here (see fig. 1, and phenogram, fig. 39, p. 138).

Pacifoculodes spinipes (Mills)
(Fig. 16)

Monoculodes spinipes Mills, 1962: 12, fig. 3.—Austin, 1985: 591.—Staude, 1987: 378.—Barnard & Karaman, 1991: 560.
non *Monoculodes spinipes* Mills, cf. Barnard, 1962: 368, fig. 10.

Material Examined: More three thousand specimens in 64 station lots, from Nahannie Beach, Oregon, north through Washington state and British Columbia to the north coast of the Queen Charlotte Islands:

BRITISH COLUMBIA.
Queen Charlotte Islands. ELB Stn. H11 (Old Massett beach), July, 1957 1 female; Virago Sound, J. W. Scoggan Stn., 1965 - 1 female.
North-central mainland coast. ELB Stns., July, 1964: ~28 specimens at H1, H37, H59 (Calvert I to Open Bight).
ELB Stn. N6 (Raynor Pt), July, 1959 - 29 specimens.
Vancouver Island, south end. ELB Stns., July, 1955: 20 specimens at P4, P6a (Long Beach), P8.
ELB Stns., July, 1970: ~310 specimens at P703, P707, P708, P711, P713; P703 (McKenzie Beach) - 17 males **(fig'd specimen),** 11 females **(fig'd. specimen)**, 14 immatures.
ELB Stns., August, 1964: ~340 specimens at H40, H41, H44.
ELB Stns., July, 1975: ~320 specimens at P1a, P4a, P8, P14a, P21a, P21b.
ELB Stns., July, 1976: 28 specimes at B4, B12a, B21, B23.
ELB Stns., May, 1977: 225 specimens at B17, B18, B19b.

WASHINGTON:
ELB Stns., July, 1966: Approxiately 2300 males, females, and larger immatures, at 11 outer coast stations (W14, W16, W18, W20, W22, W24, W33, W34, W40, W45, W46).
OREGON:
ELB Stns., August, 1966: 9 specimens at stations W50, W52, W53.

Diagnosis. Female ov. (8.5 mm): Head, rostrum regular, little deflexed distally, slightly exceeding peduncular segment 1; anterior head lobe bluntly rounded. Eye medium, partially on base of rostrum. Antennae medium, regular, not elongate. Antenna 1 peduncular segment 1 relatively short, thick anteriro-distally setose; peduncle slightly shorter than 1, setose segment 3 relatively long, >1/2 segment 2.; Antenna 2, p[eduncular segments 4 & 5 subequal in length, margins heavily setose; flagellum not longer than peduncle, 20-25 segmented..

Lower lip medium broad, inner lobes distinct. Mandible, left lacinia 5-dentate; right lacinia bifid; spine row with 5-6 blades; palp segment 3 short, outer margin distally setose, length <heavily setose segment 2. Maxilla 1, palp segment 2 outer margin setose distally. Maxilliped, inner plate short, apex 8-10 setose; outer plate medium broad with 2-3 outer distal setae; palp segment 2 broadening distally, distal margin slightly oblique.

Coxa 1 broadening distally, strongly setose below, hind margin each with 1 spines. Coxa 2, distal margin slightly oblique, hind margin with 3-4 spines Gnathopod 1, meral process strong; carpus narrow, hind lobe large, long, extending well beyond palmar angle; propod long ovate, length nearly twice depth, oblique palm much longer than posterior margin. Gnathopod 2, basis setose antero-distally; carpus very narrow, hind lobe slender, closely masking proopod, apex distinctly exceeding palmar angle, lower margin with 8-10 clusters of setae; propod slender, narrowing slightly distally to oblique palm, length ~3X maximum depth, inner face anterodistally with 4-5 clusters of setae.

Coxa 4 greatly broadened distally, moderately setose below; apex subacute. Peraeopods 3 & 4, doistal segments strongly setose behind; segment 4 very stout, setose antero-distally; segment 5 slightly longer than 6; dactyls slender, very short. Coxa 5 very brioad, deep, aequilobate. Coxa 6 deep, weakly posterolobate. Peraeopods 5 & 6 unequal in size; segment 4 regularly broadening distally, margins thickly setose; segment 6 short spinose anteriorly; dactyls short, length ~2/3 segment 6. Peraeopod 7, basis very broad proximally, hind margin gently convex, postero distal lobe large, broadly rounding depth greatly exceeding ischium; segment 6 longer than 5, not shorter than 7.

Pleon plate 2, hind corner acutely produced; pleon plate 3 broadly obtuse behind. Uropod 1, outer ramus distinctly the shorter; uropod 2, rami subequal, longer than peduncle; uropod 3, rami subeuqal, longer than peduncle apices extenidng well beyond uropods 1 & 2. Telson narrowing slightlyt distally, hind margin shallow convex, with centre pair of slender spines inside of pair of very short setae.

Coxal gills relatively short, subrectangular. Brood plates narrow, apically and marginally long-setose.

Male (4.5 mm). Single specimens subadult, little differing from female. Antenna 1 shorter than anteenna 2, flaegllum 1-2 segmented, proximal segments callynophorate but not fused. Antenna 2,peduncle 5, with asclustyers of short anterior marginal setae; flagellum nearly equal in length to peduncle, 17-segmented.

KEY TO SPECIES OF *PACIFOCULODES*
(not including P. pallidus Boeck-of doubtful synonymy?)

1. Rostrum large, apex reaching nearly to peduncular segment 2 or antenna 1; peraeopods 5 & 6, dactyls large, length ~ segment 6 . . . . .2.
—Rostrum medium, apex reaching ~ halfway (or less) along peduncular segment 1 of antenna 1; peraeopods 5 & 6; dactyls medium, length <segment 6. . . . . 3.

2. Fused eyes entirely on rostrum; peraeopod 7, basis deeper than wide . . . . *P. zernovi* (p. 110)
—Fused eyes only partially on rostrum; peraeopod 7, basis very broad, distinctly wider than deep . . . . *P. nasutus* (p. 112)

3. Pleon plate 2, hind corner subquadrate; gnathopod 2, propod elongate, length ~4 X maximum depth, distinctly narrowing distally . . . . 4.
—Pleon plate 2, hind corner acute or subacute; gnathopod 2, propod relatively short, length about 2-3 X maximum depth ,not (or slightly) narrowing distally . . . . 5.

4. Rostrum nearly straight, not deflexed distally; fused eyes partially on head and rostrum; coxa 1 little broadened distally, lower margin nearly straight . . . . *P. levingsi* (p. 108)
—Rostrum deflexed apically; eyes wholly on rostrum; coxa 1 strongly broaded distally lower margin strongly convex . . . . *P. breviops* (p. 112)

5. Peraeopods 5 & 6, segment 4 stoutly pyriform, width = length . . . . *P. dembiensis* (p. 112)
—Peraeopods 5 & 6, segment 4 regularly broadening distally, width 1/2-2/3 length . . . . 6.

6. Peraeopod 7, basis, postero-distal lobe narrow, subacute below . . . . *P. synophthalmus* (p. 112)
—Peraeopod 7, basis, hind lobe broadly rounded below . . . . 7.

7. Pleon plate 2, hind corner subacute, not produced; peraeopods 5 & 6, dactyls medium, length > 2/3 respective segment 6 . . . . 8.
—Pleon plate 2, hind corner acutely produced; peraeopods 5 & 6, dactyls short, length < 2/3 respective segment 6 . . . . .9.

8. Coxa 4 distally very broad, width ~= length (depth); coxa 2, posterior margin with 1-2 spines; peraeopods 3 & 4, dactyls medium, length >1/4 respective segment 6 . . . . *P. barnardi* (p. 105)
—Coxa 4 medium broad, width 2/3 depth; peraeopods 3 & 4, dactyls very short, length <1/4 segment 6; coxa 2, hind margin with 4-5 spines . . . . *P. crassirostris* (p. 108)

9. Peraeopod 7, segment 7 (dactyl) elongate, length >segment 6; coxa 6 weakly postero-lobate; peraeopods 5 & 6 dactyls medium, length >1/2 segment 6; antenna 2, peduncular segments 4 & 5 thickly setose . . . . *P. spinipes* (p. 102)
—Peraeopod 7, segment 7 normal, length< segment 6; coxa 6 strongly posterolobate; peraeopods 5 & 6, dactyls short, thick, length <1/2 segment 6; antenna 2, peduncular segments 4 & 5 regularly setose . . . . *P. bruneli* (p. 105)

Distributional ecology. Dominant in surf zone of open sandy beaches, from northern British Columbia to Washington, Oregon, and northern California.

Taxonomic commentary. *Pacifoculodes spinipes* is closely similar in morphology and life style to its more northerly sibling counterpart, *P. bruneli* (Fig. 41, p. 141). The species differ in characters of the key and in body size. The the line of demarcation between the two populations is Dixon Entrace, between Southeastern Alaska and the Queen Charlotte Islands.

Pacifoculodes barnardi, new species
(Fig. 17).

non *Monoculodes spinipes* Mills, cf. J. L. Barnard, 1962: 368, fig. 10.—Barnard & Karaman, 1991: 560 (part).

Material. The holotype is here designated as the 4.5 mm unsexed immature specimen of J. L. Barnard, 1962, fig. 10, from R/V Velero Stn. 4818, off Pt. Conception, California, deposited in the collections of the Allan Hancock Foundation, Santa Inez, California. The paratype in an unsexed immature

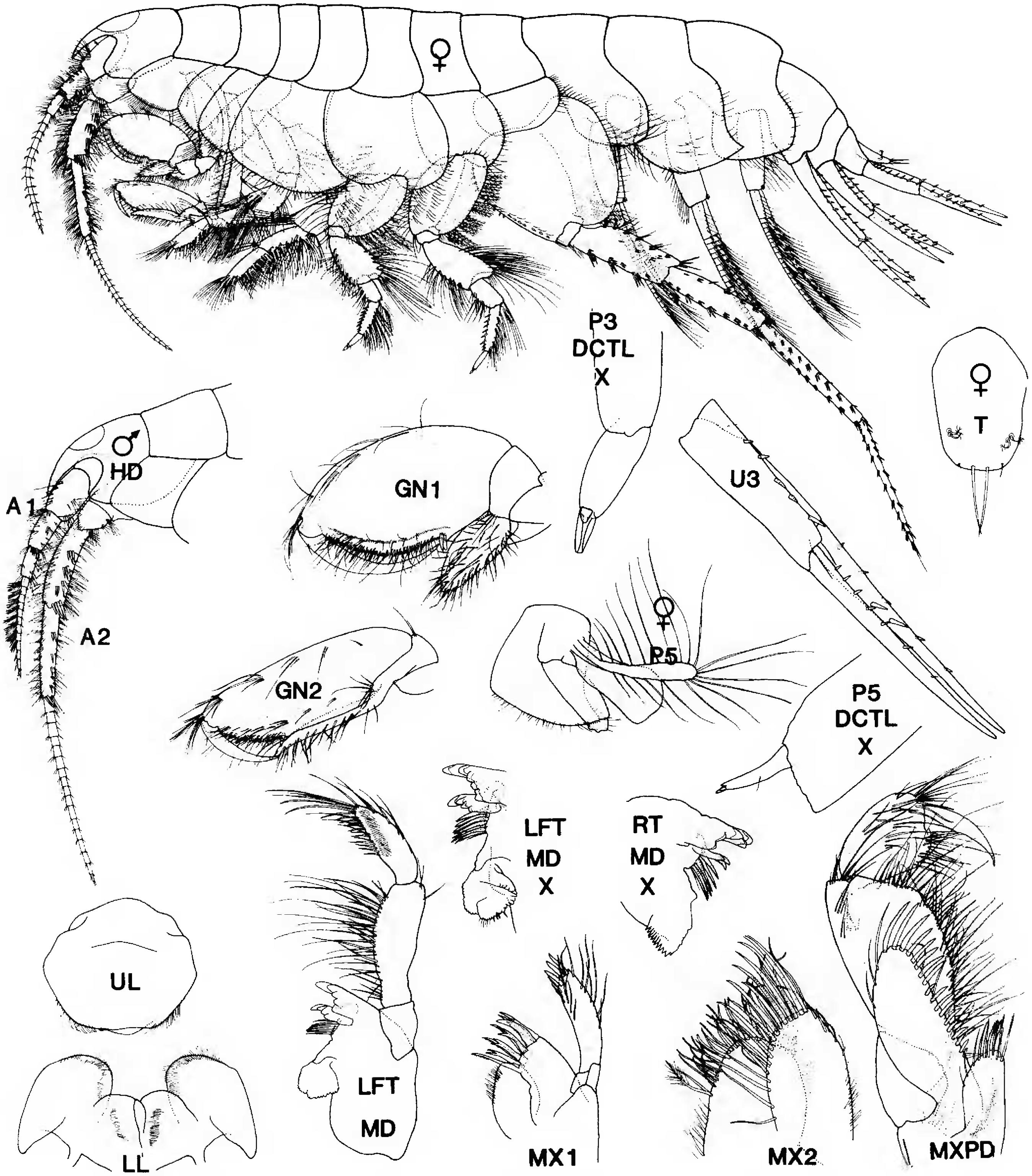

FIG. 16. ***Pacifoculodes spinipes*** **(Mills). McKenzie Beach, Vancouver Island, B. C. Female (11.0 mm); male (6.0 mm).**

from Velero Stn 4819. The specimens were not examined by the present authors.

Diagnosis. Unsexed immature specimen (4.5 mm): Head, rostrum regular, little deflexed distally, not reaching tip of peduncular segment 1 of antenna 1. Eye medium, partially on base of rostrum; lateral head lobe oblique, upper angle sharply rounded. Antennae medium, peduncles weakly setose. Antenna 1 longer than peduncle of 2; peduncular segments 1 & 2 subequal in length; segment 3 about 1/2 length of 2.; flagellum 8-segmented. Antenna 2, flagellum not longer than peduncle, ~15 segmented..

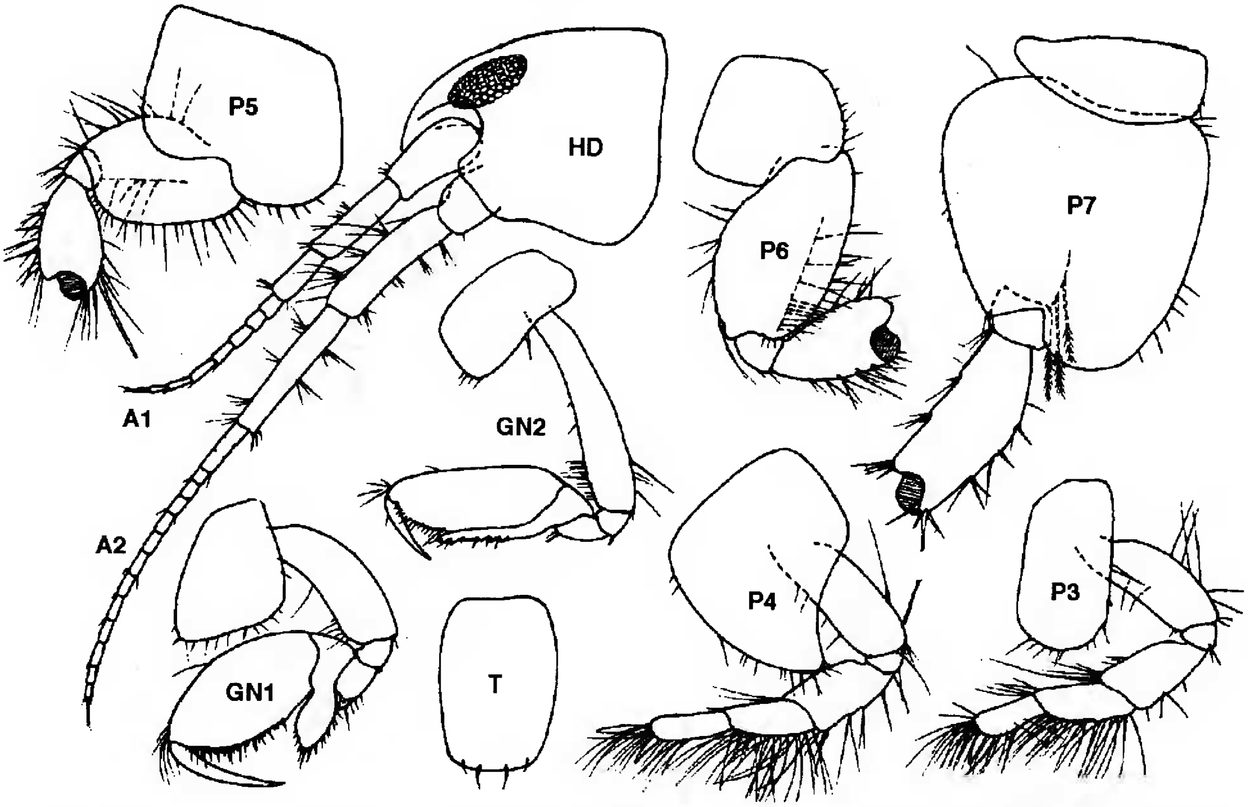

FIG. 17. ***Pacifoculodes barnardi,*** **new species. Off Pt. Conception, California. Female ? (4.5 mm). (after Barnard, 1962).**

Mouthparts undescribed.

Coxa 1 broadened distally, weakly setose below, hind margin with 1 slender spine. Coxa 2 subrectangular, hind margin with single spine. Gnathopod 1, merus with stout postero distal process; carpus short, deep, hind lobe large, rhomboidal, extending beyond palmar angle; propod elongate-ovate, palm strongly oblique, longer than hind margin. Gnathopod 2, basis weakly setose antero-distally; carpus short, hind lobe slender, slightly exceeding palm, lower distal margin with 5-6 small clusters of setae; propod slender, length ~3X maximum depth, little narrowing distally to medium oblique palm.

Coxa 4 greatly broadened distally, weakly setose below, hind process sharply rounded. Peraeopods 3 & 4, segment 4 very stout, not strongly setose; dactyls slender, length <1/2 segment 6. Coxa 5 medium deep, weakly posterolobate. Coxa 6 medium deep (length <basis), posterolobate. Peraeopod 6 larger than 5; segment 4 regularly broadening distally; distal segmented lacking, undescribed. Peraeopod 7, bases very broad proximally, hind margin convex, short-setose distally, posterodistal lobe very large, deep, exceeding ischium below.

Pleon plate 2, hind corner produced, acute. Telson subrectangular, lateral margins convex, hind margin slightly convex, with centre pair of slender spines and outer pair of short setae.

Etymology: The species is named in honour of the late J. L. (Jerry) Barnard who first described and figured the original material, and whose early studies on the North American Pacific Oedicerotidae provide a solid basis for the present undertaking.

Distributional ecology. Known only from two stations off Pt. Conception, California, in depths of 17-20 m.

Taxonomic commentary. Barnard (loc. cit.) compared his Californian material with the material of Mills (loc. cit.) from British Columbia. He noted differences in the pleon plates and in the ecological station of the two populations. These differences, combined with several other character state differences noted above and in the key (p.), are here considered sufficient for full species recognition of the Barnardian form.

Pacifoculodes bruneli, new species
(Fig. 18)

Monoculodes spinipes Mills, 1962 (part?).—Austin, 1985: 591.— Staude, 1987: 378.

Material Examined. About 200 specimens, including 20 females and 11 males from the following 15 locations:
ALASKA:
Prince William Sound Region: A140 (McLeod Harbor Beach) - 1 male, 1 female, 1 immature; A81 (Cordova Beach) - 1 male. Yakutat Inlet: A71 (Ankau Creek) - 1 immature.

Southeastern Alaska: A54 (Taylor Bay) - female (13.0 mm), **Holotype;** male (6.5 mm), **Allotype**, CMN cat. no. NMCC-1990-1181; A55 (Taylor Bay) - 1 male.
ELB Stns., Sitka region, 1980: ~120 males, females, immatures at S4B1, S4B2, S11B3, S11F1, S11F3, S18F1, S18F2, S18F3.
Southern Alexander Archipelago: ELB Stn. A7 (Bostwick Inlet) - 1 male, 1 female.

Diagnosis. Female ov (13.0 mm): Head, rostrum regular, little deflexed distally. Eye medium, partially on base of rostrum. Lateral head lobe broadly rounded, oblique. Antennae (paratype) medium, regular; antenna 1 slightly longer than peduncle of antenna 2; peduncular segment 2 shorter than segment 1; segment 3, length about 1/2 segment 2 . Antenna 2, flagellum not longer than peduncle, 20-25 segmented.

Mandible, left lacinia 5-dentate; right lacinia irregularly bifid; spine row with 6-7 blades; palp stout, segment 3 shorter than segment 2. Maxilla 1, palp segment 2 with 8 disto-lateral marginal setae. Maxilliped, inner plate very short, apex rounded, with single slender spine and several setae; outer plate medium, with 6-7 distal outer marginal setae; palp segment 2 medium broad, distal margin oblique.

Coxa 1-4 increasing in size and depth posteriorly, lower margins strongly setose, hind margins with spines. Gnathopod 1, meral process strong; carpus narrow, hind lobe large, long, extending well beyond palmar angle; propod large, subovate, length ~1.5X depth; length of palm more than twice posterior margin. Gnathopod 2, carpus narrow, hind lobe very slender, slightly exceeding palm, lower margin with 15+clusters of setae; propod slender, narrowing distally to short oblique palm, length ~3X maximum depth, inner surface antero-distally with 4-5 clusters of setae.

Coxa 4 greatly broadened and produced distally. Peraeopods 3 & 4, segment 4 antero-distally very stout, setose; dactyls slender, short, length <1/3 segment 6. Coxa 5 very deep, aequilobate. Coxa 6, depth = length of basis, postero-lobate. Peraeopods 5 & 6 dissimilar; segment 4 regularly broadening distally; segment 6 weakly setose antero-distally; dactyls short, <1/2 length of segment 6, chitinous rings small. Peraeopod 7, bases very broad, hind margin strongly convex, postero-distal lobe deep, exceeding ischium.

Pleon plate 2, hind corner acuminate, slightly produced., pleon plate 3 broadly obtuse behind. Uropod 1, rami shorter than peducnle, outer ramus the shorter Uropods 2 & 3 rami subequal tips extending rearwards equidistant;margins with 6-8 short spines. Telson short-rectangular, hind margin truncate, with submedian pair of slender spines inside pair of minute setae.

Male (6.5 mm): Anterior head lobe more sharply rounded, eye distinctly larger than in female. Antenna 1, flagellum 10 segmented, basal segments callynophorate but not conjoint. Antenna 2, peduncular segments 4 & 5 relatively long, anterior margins with some longish bruch setae; flagellum not elongate.

Etymology: The species is named in honour of Dr. Pierre Brunel, Université de Montreal, Québec, an outstanding contributor to knowledge of benthic marine systematics and ecology, who has provided laboratory facilities, reference material, and helpful advice for the present study.

Distributional Ecology: Known only from exposed and semi-protected sand beaches of southeastern Alaska, in the region from Prince William Sound south to Cross Sound; an apprent ecological counterpart to the more southerly *M. spinipes* Mills.

Taxonomic commentary. *Pacifoculodes bruneli* might be considered a sibling species of *P. spinipes* Millls, so closely is it similar in morphology and life style. However, the character of the key (p. 104) apply consistently well to larger immatures and to mature males and females, confirming the separation of the two forms at species level.

A member of the *spinipes* group but differing mainly in the more steeply decurved rostral frontal margin; shorter carpal lobe of gnathopod 1; very slender propod of gnathopod 2, with distally protruding carpal lobe; bluntly upturned pleon 2 hind process, and distally broad telson with 4 marginal setae.

Pacifoculodes crassirostris (Hansen)?
(Figs. 19, 20)

Monoculodes crassirostris (Hansen) Gurjanova, 1951: 568, figs. 374B, 375.—Ledoyer, 1972: 769, figs. 1, 2, 3J, 3K.
non *Monoculodes crassirostris* Hansen, 1887: 108, figs. 5, 5f.—Gurjanova, 1951: 568, figs. 374B, 375.—Barnard & Karaman, 1991: 559.

Material Examined.
ALASKA:
Aleutian Islands. Unimak I., P. Slattery Stns., 1982: C28 - 1 female; C66- 1 female (11.5 mm) CMN cat. no. NMCC-19900447; C94 - 3 immatures; C112 - 1 immature; C113 - 1 immature. CMN collections, Ottawa.

Taxonomic commentary. Ledoyer (1972) first suggested that *M. crassirostris* Hansen, as figured and described from Russian far eastern waters by Gurjanova, 1951, differed significantly from *M. crassirostris* Hansen, 1887, from northwestern European waters. Although material has not been examined here, Ledoyer's decision seems soundly based. We therefore take the liberty of rediagnosing the material of Gurjanova (loc. cit.), refigured by Ledoyer (loc. cit.), to accentuate differences from other members of the genus *Pacifoculodes.*

Diagnosis. Female (11.5 mm). Head, rostrum medium strong, slightly deflexed apically. Eye nearly fully basally on rostrum; anterior head lobe short, subacute. Antenna 1 short, barely extending beyond peduncle of antenna 2; peduncular

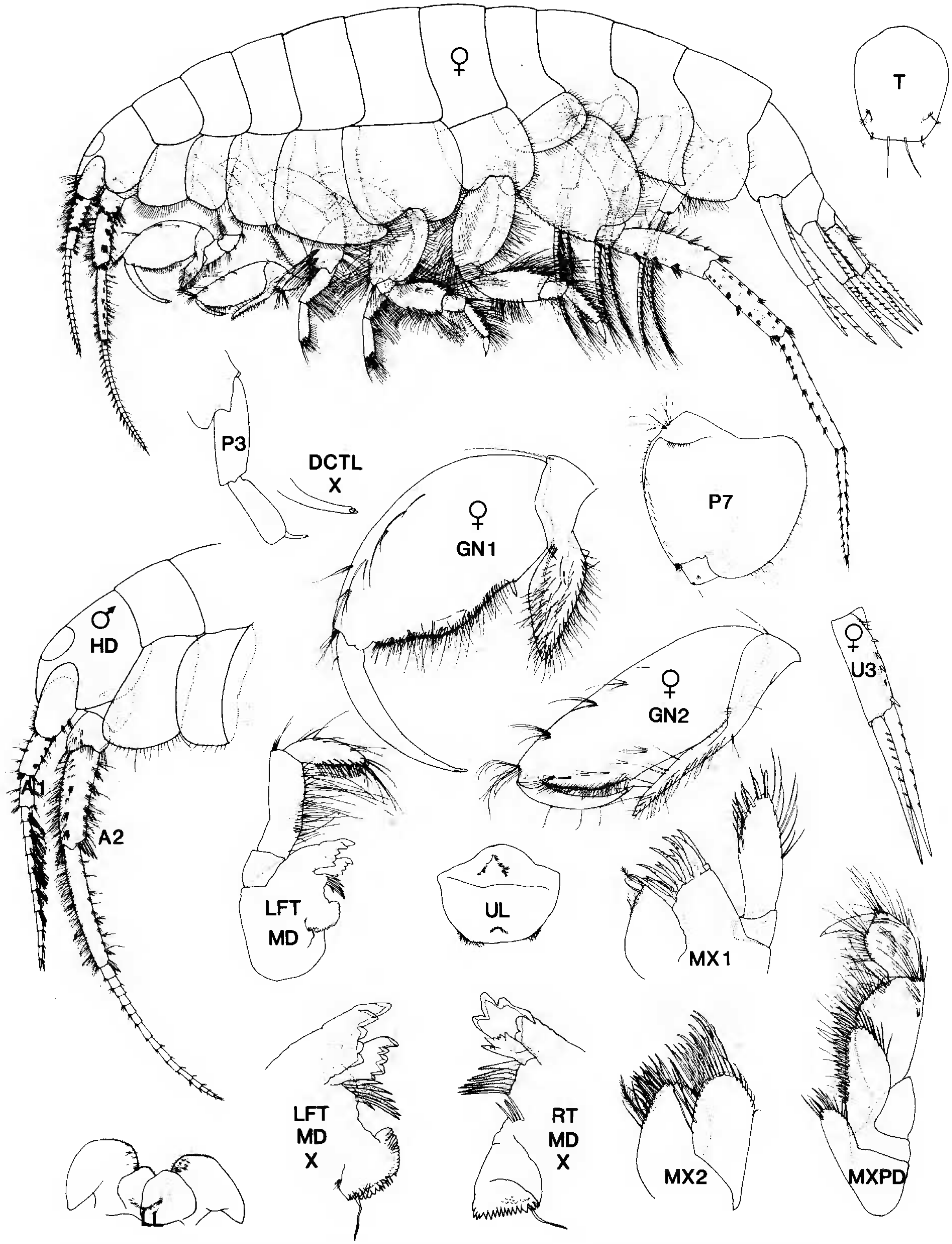

FIG. 18. ***Pacifoculodes bruneli*, new species. Taylor Bay, Southeastern Alaska. Female (13.0 mm); male (6.5 mm).**

segment 1 thick, heavily setose anteriorly; segment 2 subequal to 1 but much less setose; segment 3 short; flagellum ~12-segmented. Antenna 2, peduncular segment 5 >4, both strongly setose, flagellum<peduncle, ~ 30-segmented.

Mandible, spine row with 5-6 blades; palp segment 3 slender, spinose and setose; palp 3 much shorter, outer margin setose. Maxillae 1 & 2 not described. Maxilliped, inner plate, apex with single spine and several setae; outer plate

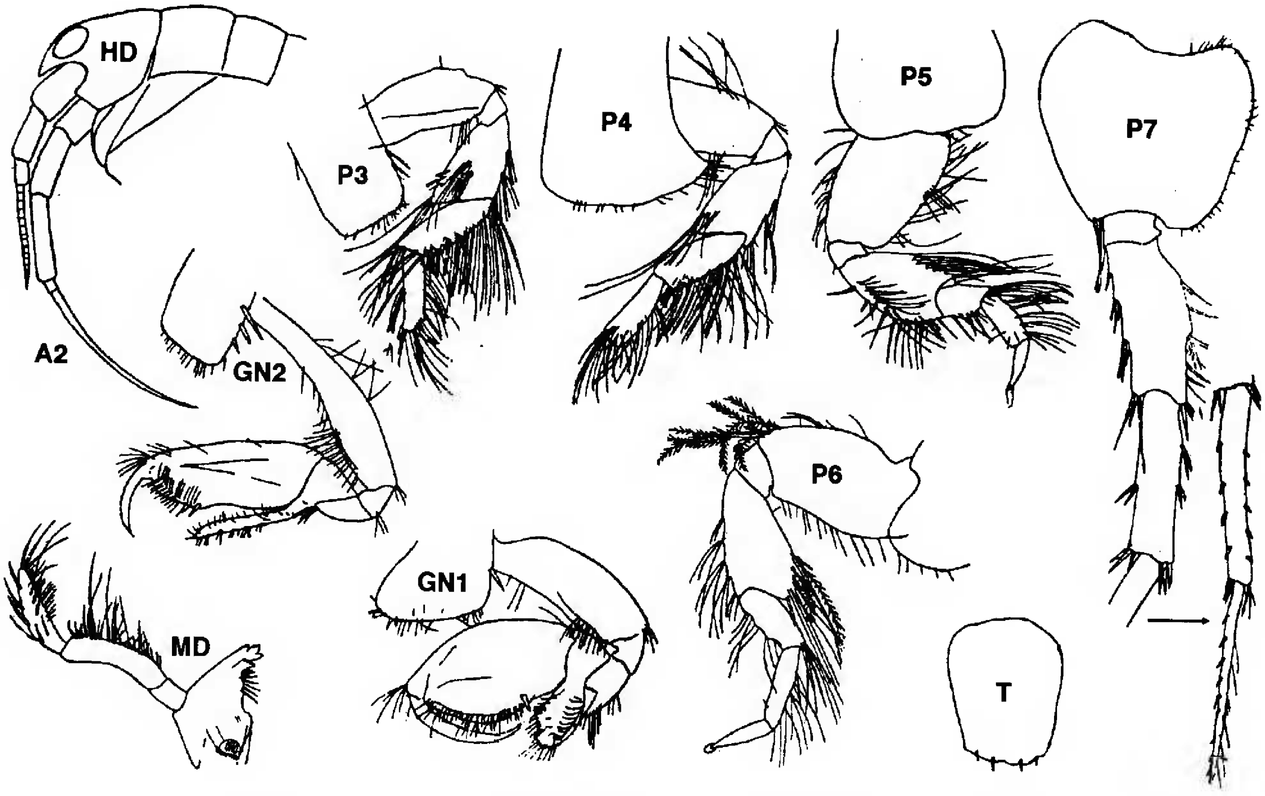

FIG. 19. *Pacifoculodes crassirostris* (Hansen)? Japan Sea. Female (10.0 mm). (after Gurjanova, 1951).

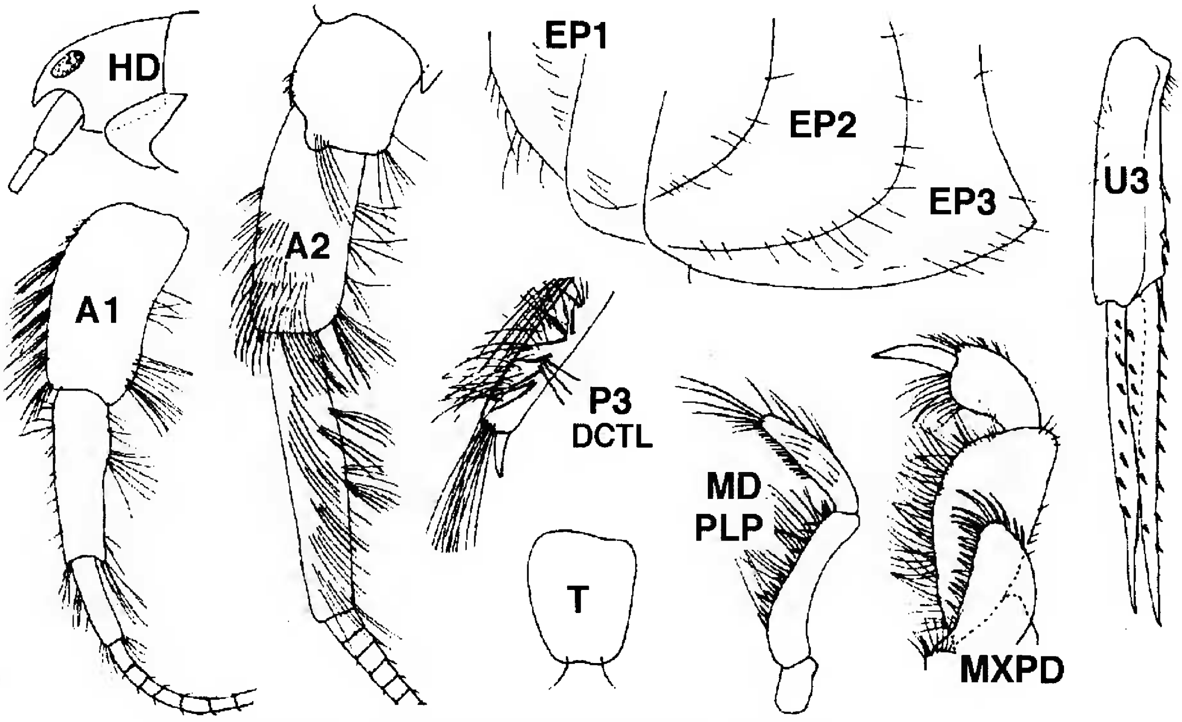

FIG. 20. *Pacifoculodes crassirostris* (Hansen)?. Female (13.0 mm?). Sea of Japan. (after Ledoyer, 1972).

medium broad; palp segment 2 broad, distal margin oblique.

Coxae 1 & 2, hind margins with 2-5 slender spines respectively. Gnathopod 1, merus with strong posterior process; carpus narrow, hind lobe broad, diamond-shaped, apex exceeding palmar angle; propod stout, long-ovate; posterior margin short,< 1/2 strongly oblique palmar margin. Gnathopod 2, carpus narrow, hind lobe slender, weakly setose, apex exceeding palmar angle; propod, length 2.5 X greatest width, narrowing slightly distally to oblique palm.

Coxa 4 not strongly broadened distally, hind process acute. Peraeopods 3 & 4 strongly fossorial, setose; segment 5 >>6 and strongly setose behind; dactyls very short . Coxa 5 medium, aequilobate; segment 4 strongly broadening distally; segment 5 short; segment 6 weakly or not setose anteriorly; dactyls medium, length 2/3 segment 6. Peraeopod 7, basis, hind margin broadly rounding proximally, nearly straight distally, hind lobe medium deep (not exceeding ishium), broadly rounding.

Pleon plate 2, hind corner subacute, little produced. plate 3 broadly obtuse. Uropod 1, rami <peduncle, outer ramus marginally bare. Uropod 2 & 3, rami >respective peduncles, with numerous marginal spines. Telson small, narrowing to nearly straight apical margin bearing 2 medium and 2 short setae.

Distributional commentary. Known from the northwestern Pacific, including Bering Strait and northeastern Atlantic, subtidally at shelf depths.

Taxonomic commentary. As Ledoyer detailed, material from the Bering Sea region is distinct from Hansen's species. Although in agreement with Ledoyer's conclusions, we prefer that this species be formally named by a further revisor who examines all pertinent materials.

Pacifoculodes levingsi, new species

(Fig. 21)

Material Examined.
BRITISH COLUMBIA:
North-central coast, C. Levings Stns., Swanson Bay, 1975: Stn. J - 1 female ov. (6.0 mm), **Holotype** (slide mount), CMN Cat no. NMCC1990-464, Ibid, 2 imm, **Paratypes**; Stn JC - 1 female, 1 male; Stn M - 1 female, 2 im (1 with head only)

Diagnosis. Female ov. (6.0 mm): Head, rostrum regular, little deflexed distally. Eye medium, partially on base of rostrum. Lateral head lobe oblique, upper angle squared. Antennae (paratype) medium, regular; antenna 1 longer than peduncle of 2; peduncular segments 2 & 3 relatively short. Antenna 2, flagellum not longer than peduncle.

Mandible, left lacinia irregularly 7-dentate; right lacinia bifid; spine row with 5-6 blades; palp segment 3 slender, length <segment 2. Maxilla 1, palp segment 2 sparsely setose. Maxilliped, inner plate very short; outer plate with 4-5 outer distal setae; palp segment 2 medium broad.

Coxa 1 & 2 strongly setose below, hind margin each with 2 spines. Gnathopod 1, carpus longer than deep, hind lobe large, long, extending beyond palmar angle; propod subrectangular, relatively long, length ~2X depth; palm shorter than posterior margin. Gnathopod 2, carpus shorter than deep, hind lobe very slender, slightly exceeding palm, lower margin with 8-10 clusters of setae; propod slender, narrowing distally to short oblique palm , length 4-5X maximum depth inter surface antero-distally with 5-6 clusters of setae.

Coxa 4 greatly broadened distally, setose below. Peraeopods 3 & 4, segment 4 very stout, setose; dactyls slender, length ~ 1/2 segment 6. Coxa 5 aequilobate, medium deep. Coxa 6 medium, deep, posterolobate. Peraeopods 5 & 6 unequal in size; segment 4 regularly broadening distally; segment 6 weakly setose antero-distally; dactyls ~2/3 length of segment 6. Peraeopod 7, bases very broad, hind margin convex, postero distal lobe shallow.

Pleon plate 2, hind corner squarish, pleon plate 2, broadly obtuse behind. Uropods 1-3 rami subequal, weakly marginally spinose. Telson short-rectangular, hind margin irregularly shallow-convex, with centre pair of slender spines inside of pair of short setae.

Coxal gills relatively short, rounded below. Brood plates short, apically with 9-10 simple setae.

Male (4.5 mm). Single specimens subadult, little differing from female.

Etymology: The species is named in honour of Dr. Colin R. Levings, Pacific Environmental Institute, who collected the type specimen, and whose biological survey work has added greatly to knowledge of the marine fauna of the northeastern Pacific coastal region.

Distributional Ecology. Known only from the type locality at Swanson Bay, B. C., in silty mud, at 30-45 m.

Taxonomic Commentary: Although the type specimen lacks antennae and distal portions of peraeopods, the taxonomic features of the mouthparts, coxal plates and peraeopods, are unlike those of other known species of the genus (see key, p. 104).

Pacifoculodes zernovi (Gurjanova)

(Figs. 22, 23)

Monoculodes zernovi Gurjanova, 1936: 374A, figs, 23, 23A.—Gurjanova, 1951: 566, figs. 373, 374A.—Mills, 1962: 9, fig. 2.—Austin, 1985: 591.—Staude, 1987: 378, fig. 18.68.—Barnard & Karaman, 1991: 560.

Material Examined. Approximately 100 specimens in in 21 lots, from the Seward Peninsula and the Bering Sea, southward to the south end of Vancouver Island, as follows:
ALASKA:
Bering Sea region. C. E. O'Clair, Stn., Constantine Harbor, 1969 - 1 immature. P. Slattery Stns., 1983: St. Matthew I., - 2 specimens; Walrus Cove - 27 specimens.

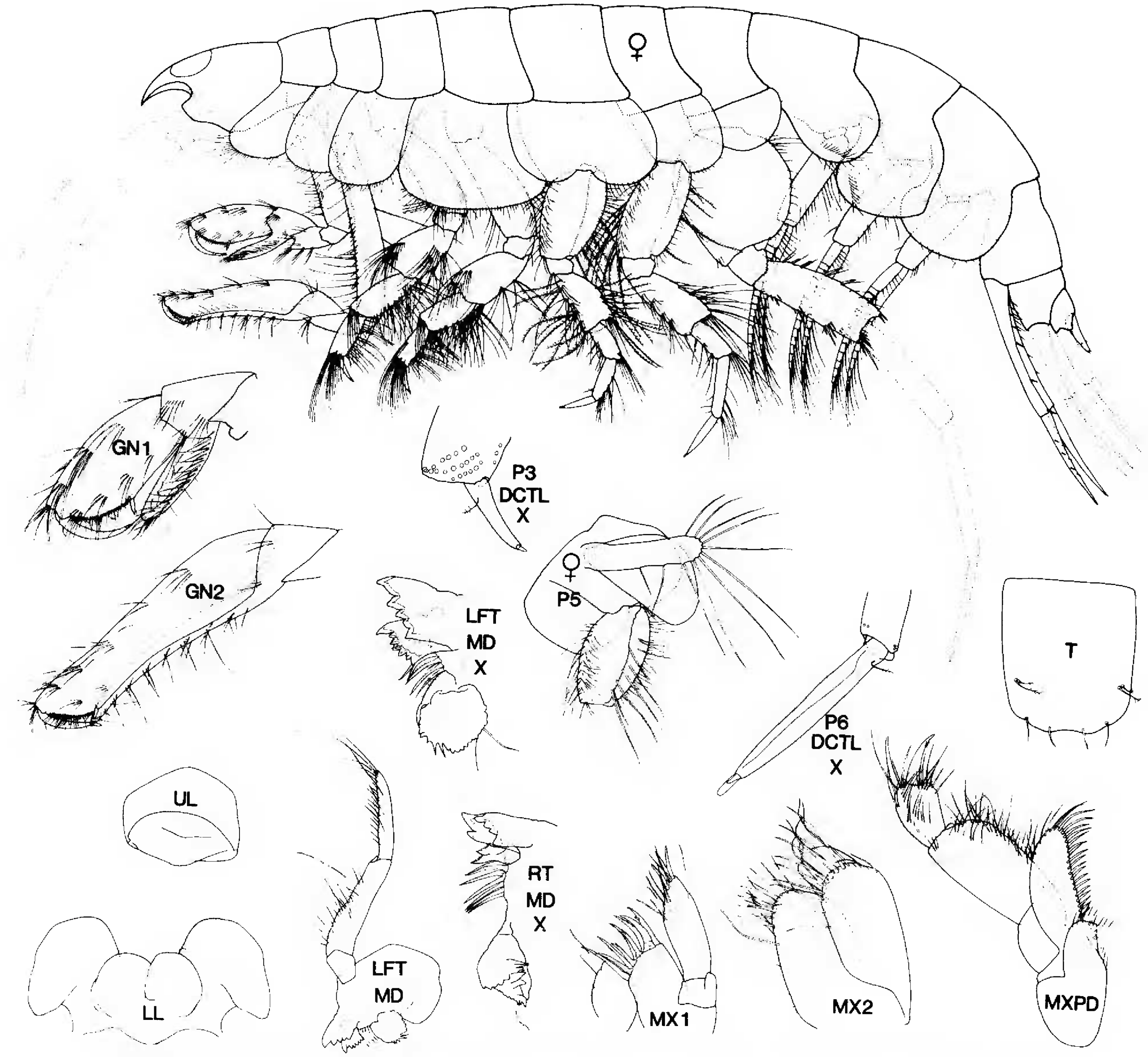

FIG. 21. ***Pacifoculodes levingsi*, new species. Swanson Bay, B. C. Female (6.0 mm).**

Mainland coast, 1981: Cape Nome - 18 specimens; Cape Rodney - 1 female, 3 immatures.
Southeastern Alaska. ELB Stn. A135 (Resurrection Bay). glacial mud, 24 m. - 1 immature.

BRITISH COLUMBIA:
Queen Charlotte Islands. ELB Stn. E14e (Gillat I.), July, 1957 - 14 immatures.
North-central coast. ELB Stns., July, 1964: 4 specimens at H17, H21, H34, H36.
South-central mainland coast. ELB Stn. E3 (off Dollarton), coarse sand, woody detritus, 16-20 m., Nov. 4, 1977 - 2 specimens.
Vancouver Island. ELB Stn. P26 (Koprino Harbour), mud, shell, 12-16 m., Aug. 14, 1975 - 11 immatures; ELB Stn. B1 (Departure Bay, off Hammond Beach), sandy mud, 5-17 m., May 14, 1977 - 3 immatures; B6b (Trial Island), LW level-1 immature.
G. W. O'Connell Stn. W153b (Victoria, off Clover Pt.), Aug., 1976 - 2 immature females (to 8.0 mm).

Diagnosis. Female ov. (11.0 mm): Head deeply incised below very large nearly straight rostrum, anterior head lobe short, acute. Eye large, centrally on rostrum. Antenna 1, peduncular segments 1 & 2 slender, subequal, 3 short; flagellum 15-20 segmented, distally weakly setose, slightly exceeding peduncle of antenna 2. Antenna 2, peduncular segment 4 setose, stronger and longer than 5; flagellum elongate, flagellum ~40-segmented, longer than peduncle.

Lower lip broad, inner lobes distinct. Mandible, left lacinia irregularly 5-dentate; right lacinia bifid; spine row with 5-6 blades; palp segment 3 very slender, length slightly less than segment 2. Maxilla 1, palp segment 2, outer margin distally setose. Maxilliped, inner plate very short, apex setose; outer plate tall slender, with 4-5 outer distal setae; palp segment 2 broad, distal margin oblique; dactyl curved.

Coxa 1 broadened distally, strongly setose below, hind margin bare. Coxa 2 strongly setose below, hind margin with

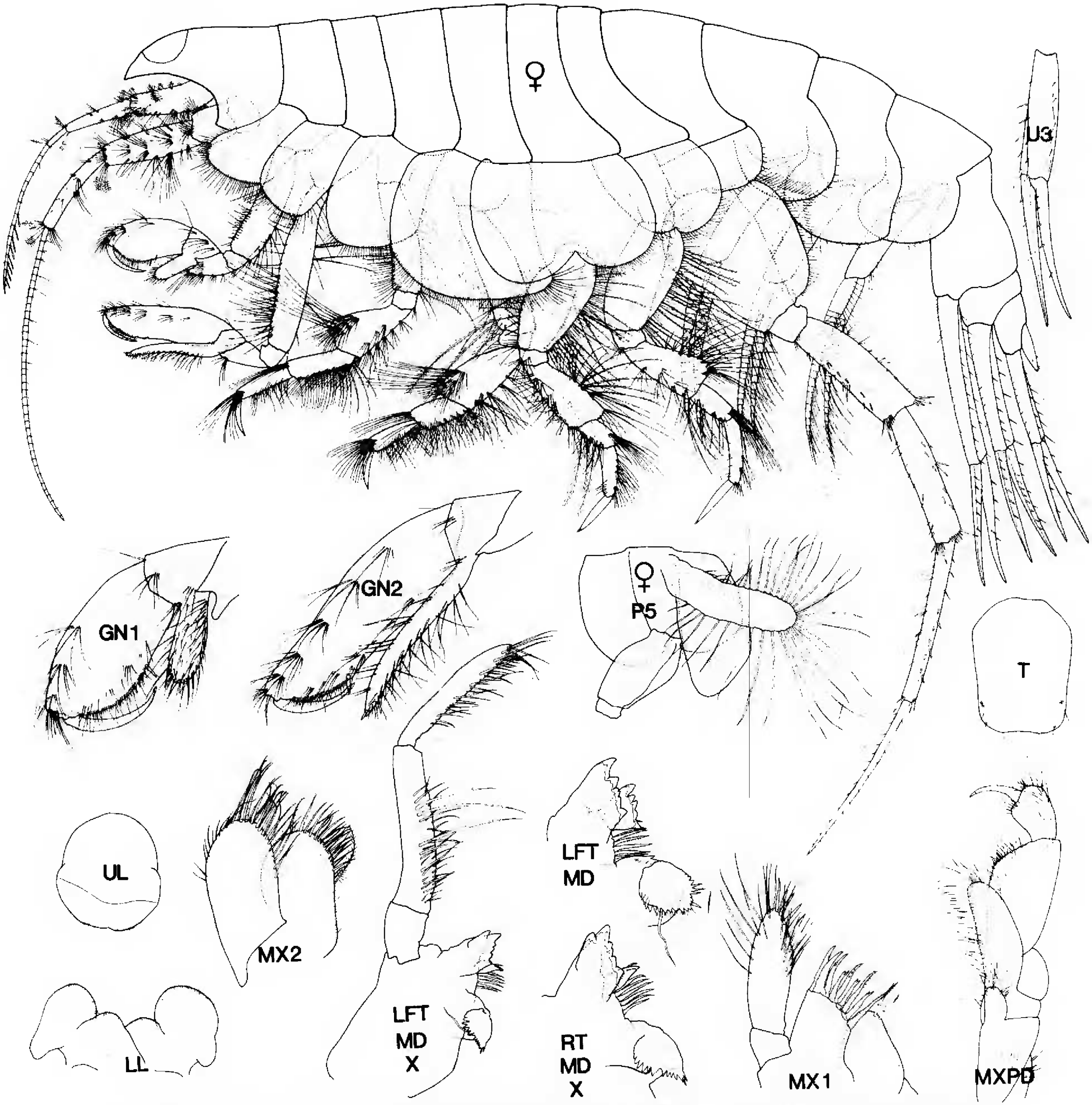

FIG. 22. ***Pacifoculodes zernovi*** **(Gurjanova) Cape Nome, Alaska. Female 17.0 mm.**

3-4 short spines. Gnathopod 1, meral hind process strong; carpus longer than deep, hind lobe broad, extending slightly beyond palmar angle; propod subrectangular, relatively long, length about twice maximum depth; palm strongly oblique, length ~posterior margin. Gnathopod 2, basis strongly setose antero-distally; carpus shorter than deep, posterior lobe very slender, not closely approximating hind margin of propod , apex slightly exceeding palm, lower margin strongly setose; propod slender, narrowing distally to short oblique palm, length 3-4X maximum depth, inner surface anterodistally with 5 clusters of setae.

Coxa 4 broadened distally, setose below, hind process sharply rounded. Peraeopods 3 & 4, segment 4 very stout distally and strongly setose; segment 5 slightly longer than 6, strongly setose below; dactyls slender, length ~2/3 segment 6. Coxa 5 deep, broad, aequilobate. Coxa 6 relatively broad, weakly posterolobate. Peraeopods 5 & 6 unequal in size; segment 4 regularly broadening distally; segment 6 weakly setose antero-distally; dactyls stout, length ~segment 6. Peraeopod 7, bases regularly broad, hind margin convex, postero distal lobe shallow, broadly rounded.

Pleon plate 2, hind corner squarish, that of pleon plate 3 broadly obtuse. Uropods 1-3, rami slender, weakly marginally spined, extending subequally. Telson subrectangular, hind margin subtruncate, with centre pair of slender spines flanked by pair of short setae.

Coxal gills regular, subrectangular. Brood plates relatively large, broad, margins and apex strongly setose.

Mature male unknown.

Distributional ecology. Widely distributed along open sandy beaches, from the Bering Sea to southeastern Alaska, and south-ward to southern British Columbia subtidally to depths of 40 m.

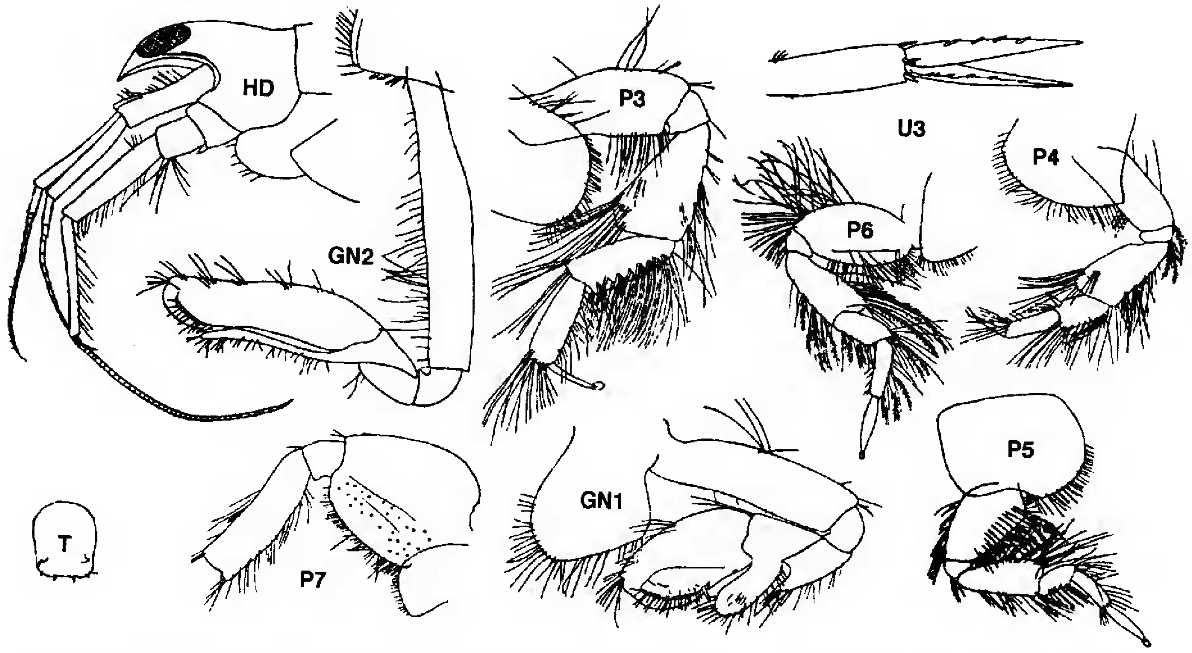

FIG. 23. ***Pacifoculodes zernovi*** **(Gurjanova). Japan & Okhotsk Seas. Female (15.0 mm). (after Gurjanova, 1951).**

Taxonomic commentary. As noted below (p.140), *P. zernovi* is strikingly unlike other North American Pacific species, with closest similarity to the Asiatic *P. nasutus* (Bulycheva). The North American Pacific material from the Bering sea region compares very closely with that from the Sea of Japan, described and illustrated by Gurjanova (1951). However, the more southerly North American specimens are slightly smaller at maturity, the coxa of peraeopod 5 appears somewhat broader, and peraeopod dactyls are slightly shorter.

Western Pacific Species of *Pacifoculodes*

Several species of *Monoculodes* (sens. lat.) were initially described with little or no reference to the mouthparts, uropods, or degree of sexual dimorphism. These species are assigned (below) to the genus *Pacifoculodes* on features of the head, gnathopods, peraeopods, and telson.

Pacifoculodes synophthalmus (Bulycheva)

Monoculodes synophthalmus Bulycheva, 1952: 209, fig. 11.—Barnard & Karaman, 1991: 560.

Taxonomic and distributional commentary. *Pacifoculatus synophthalmus* is a medium large western Pacific surf zone ecological counterpart to *P. spinipes* and/ or *P. bruneli.* It is distinctive in the very acute postero-distal lobe of the basis of peraeopod 7.

Pacificulodes dembiensis (Bulycheva)

(Fig. 24)

Monoculodes dembiensis Bulycheva, 1952: 214, fig. 15.—Barnard & Karaman, 1991: 559.

Taxonomic and distributional commentary. *P. dembiensis* occurs subtidally to depths of 6 m, from the Sea of Japan to the southern Kamchatka peninsula. This large (females to 18 mm), powerfully fossorial species is very distinctive in its large and powerful propod of gnathopod 1, very broadly expanded segment 4 of peraeopods 5 & 6, very wide basis of peraeopod 7, and extremely short, almost minute dactyls of peraeopods 3 & 4.

Pacifoculodes nasutus (Bulycheva)

(Fig. 25)

Monoculodes nasutus Bulycheva, 1952: 211, fig. 13.—Barnard & Karaman, 1991: 560.

Taxonomic and distributional commentary: This medium-sized species (female to 11.0 mm) has been recorded subtidally in depths of 70 - 351 m in the northern Sea of Japan. Its long slender rostrum, small broad coxa 1, very wide basis of peraeopod 7, and slightly emarginate telson are distinctive features.

Pacifoculodes breviops (Bulycheva)

Monoculodes breviops Bulycheva, 1952: 213, fig. 14.—Barnard & Karaman, 1991: 559.

Taxonomic and distributional commentary. *P. breviops* is a small species (female 5-6 mm) that been taken subtidally to depths of 55 m in the northern part of the Sea of Japan. It is distinguished by the small eye located distally on the apically deflexed rostrum, the small broadly rounded coxal plate 1, and very elongate propod and narrow palmof gnathopod 2.

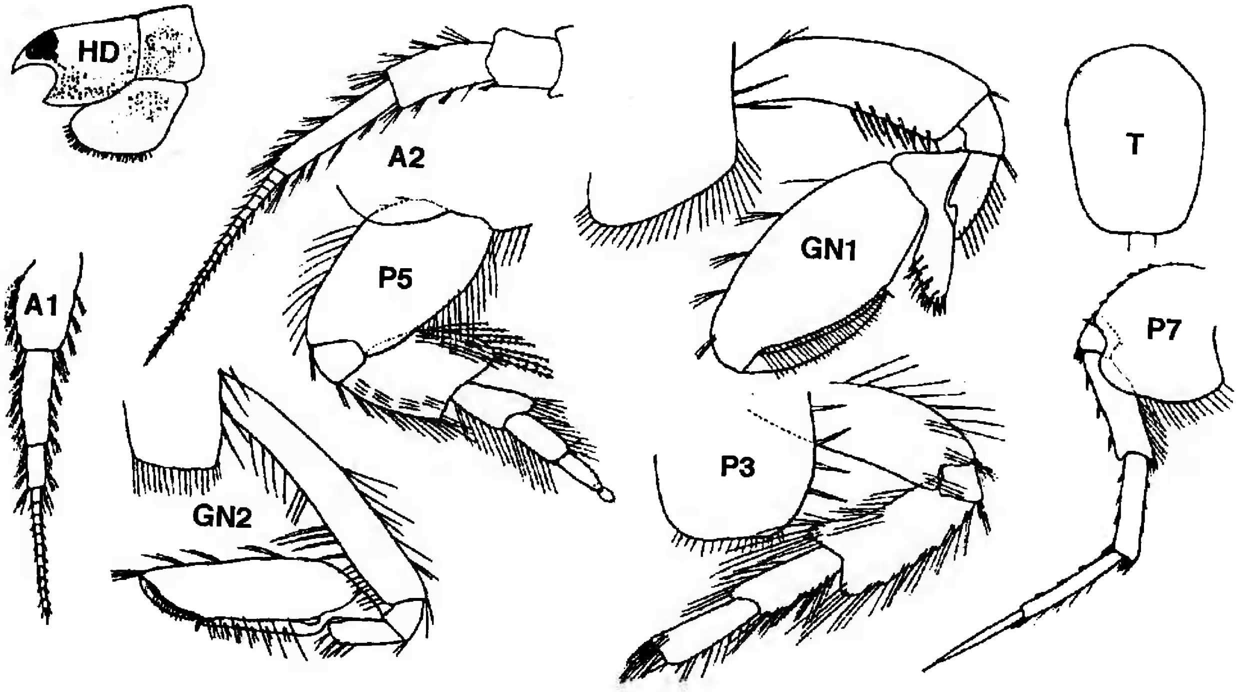

FIG. 24. *Pacifoculodes dembiensis* (Bulycheva). Japan Sea, Kamchatka. Female (6 - 7 mm).
(after Bulycheva, 1952)

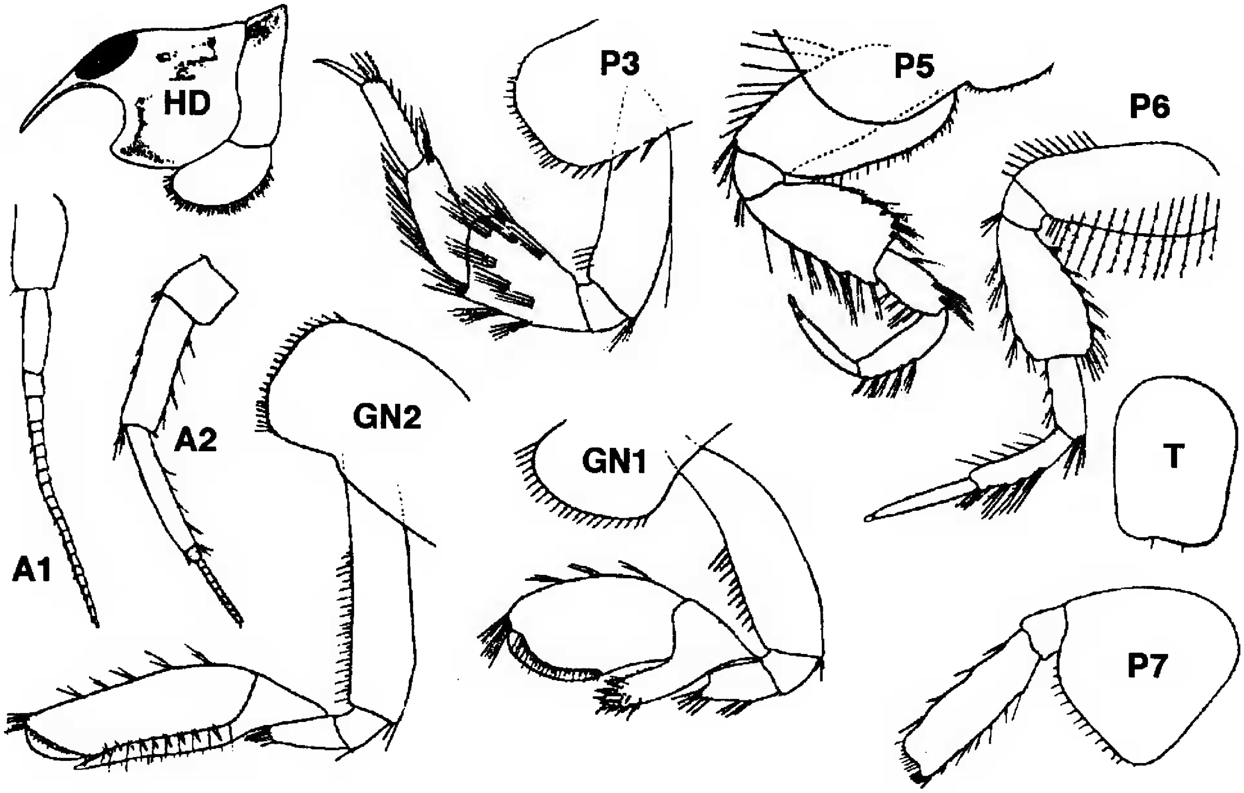

FIG. 25. *Pacifoculodes nasutus* Bulycheva. Japan Sea, to 150 m. Female (11.0 mm).
(after Bulycheva, 1952).

Limnoculodes, new genus

Monoculodes Stimpson (part).—Tattersall, 1922: 440.—Nagata, 1965: 169.—Morino, 1990: 14.—Barnard & Karaman, 1991: 559.—Ishimaru, 1994: 71.

Type species. *Monoculodes limnophilus* Tattersall, 1922: 440, present selection.

Species: *Limnoculodes japonicus* (Nagata, 1965).

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Diagnosis. A primitive but distinctive genus. Head, rostrum deflexed apically. Eyes fully on rostrum, sexually dimorphic. Antennae short, sexually dimorphic. Antenna 1 short, segments 2 & 3 very short; flagellar segments callynophorate in male. Antenna 2, peduncular segments 4 & 5 with anterior marginal brush setae in male.

Lower lip, inner lobes medium. Mandible, molar triturative; left lacinia 5-dentate, right lacinia toothed; palp weak, segment 2 medium. Maxilla 1, inner plate triangular, with 1 apical seta; outer plate with 9 apical spines; palp slender, segment 1 long. Maxilla 2, inner plate small, weakly setose. Maxilliped, inner plate reduced, apex truncate, with 3 strong setae; outer plate with stout inner marginal teeth; palp 2 stout, broadening distally, segment 3 & dactyl short.

Coxa 1 moderately broadened distally, lower margin convex. Gnathopod 1 larger than gnathopd 2; propod elongate-ovate, palm long, oblique, convex; carpal lobe medium Gnathopod 2, basis not setose anteriorly; carpus short, lobe medium,reaching palmar angle; propod relatively short,length 2.5 X maximum depth.

Coxa 3 normal, coxa 4 deep, broad. Peraeopods 3 & 4, segment 4 moderately fossorial; segment 5 slightly longer than segment 6; dactyls medium, chitinous rings minute.

Coxa 5 deep, broad, slightly postero-lobate. Coxa 6 broad, deep. Peraeopods 5 & 6, bases dissimilar; segment 4 not strongly fossorial; segment 5 shorter than 6; dactyls medium strong, thick, chitinous rings minute. Peraeopod 7, basis relatively narrow, with lower hind lobe; segments 6, anterior margin bare; dactyl thick, shorter than segment 6.

Pleon plates 2 & 4, broadly obtuse and/or rounded behind. Uropods 1,2,& 3, outer ramus distinctly the shorter. Telson short, apex truncate,with 2 apical setae.

Coxal gills sac-like, elongate, rounded distally. Brood plates very slender, strap-like, margins setose distally.

Taxonomic commentary. Formal recognitionof monotypic, or near-monotypic, genera is justified when several taxonomic features are distinct or unique . In *Limnoculodes,* the very short antenna 1, structure of the mouthparts,the large propod of gnathopod 1 and small propod of gnathopod 2, and acutely lobate basis of peraeopod 7, are features unlike all other genera.

Limnoculodes appears least remote fromgenus *Monoculodes* sens. str. but shares some features with the N. American mesohaline genus *Ameroculodes.*

Limnoculodes limnophilus Tattersall
(Fig. 26)

Monoculodes limnophilus Tattersall, 1922: 440, Pl. 18, figs.10-20.—Morino, 1990: 14, figs 5-8.—Barnard & Karaman, 1991: 560. Ishimaru, 1994: .

Taxonomic commentary. This species is unique. Nagata (1965) described a brackish water form from Japan as *Monoculodes limnophilus japonicus.* However, in redescribing Tattersall's species, Morino (1990) recommended that the differences noted by Nagata (loc. cit.) between the Japanese form and Tattersall's original species, should be recognized at specific rank. These differences do not transcends the generic limits of *Limnoculodes* established above.

Monoculopsis G. O. Sars

Monoculopsis G. O. Sars, 1895: 310.—Stebbing, 1906: 257.—Gurjanova, 1951: 560.—Barnard & Karaman, 1991: 560.

Type species. *Monoculodes longicornis* Boeck 1871, by monotypy.

Species. *Monoculopsis vallentini* Stebbing, 1914: 360.

Diagnosis: Body smooth. Rostrum short, regular. Pigmented eyes basal. Antennae weakly sexually dimorphic. Antenna 1 longer than antenna 2 (adult), not callynophorate in male; peduncular segment 3, length = segments 1, 2.

Lower lip, inner lobes separate. Mandible, molar triturative; spine row with 4 blades; left lacine 5-dentate; right lacinia flabellate; incisor strongly toothed; palp regularly 3-segmented, segment 3 shorter than 2. Maxilla 1, inner plate with 2 apical setae; outer plate with 8-9 apical spines; palp regularly 2-segmented. Maxilla 2, plates small, regular, inner plate lacking facial setae. Maxilliped, inner plate with apical setae; outer plate medium, margins convex, apex rounded; palp segment 2 stout; dactyl strong.

Coxa 1 broadened distally. Coxa 4 broad. Gnathopods 1 & 2 strongly subchelate, propods dissimilar in form and size, narrowing distally, palms short, oblique; carpus, anterior margin distinct, hind lobe elongate, guarding propod below.

Peraeopods 3-4 strongly fossorial; segment 5 longer than 6; dactyls short. Coxae 5 broad, deep, anterolobate. Coxa 6 postero-lobate. Peraeopods 5 & 6 somewhat unequal, bases dissimilar; segment 5 short; dactyls medium. Peraeopod 7, basis broad, postero-dstal lobe distinct; dactyl elongate.

Pleon plate 2 subquadrate; pleon plate 3 rounded behind. Uropods 1-3 regular; rami regularly lanceolate, outer ramus slightly the shorter.

Telson short, narrowing distally, apex subtruncate.

Coxal gills and brood plates undescribed.

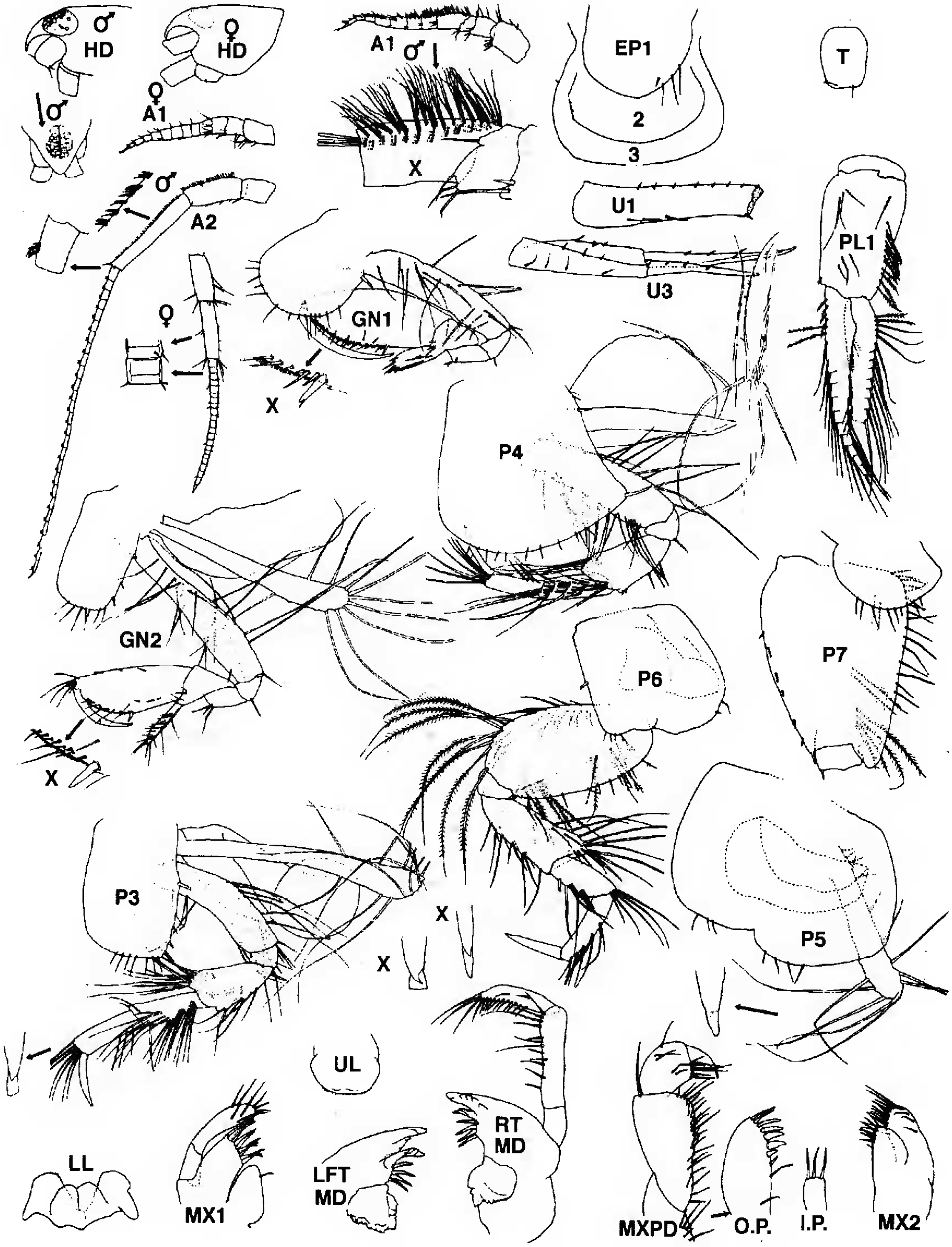

FIG. 26. ***Limnoculodes limnophilus*** **Tattersall. Western North Pacific. Male (5.0+ mm); female (5.0 mm) (after Morino, 1990).**

Taxonomic commentary: *Monoculopsis* is a member of the *Monoculodes* group of oedicerotids, having a strongly triturative mandibular molar, and elongate carpi of gnathopods 1 & 2 that guard the propods posteriorly. The genus differs from *Monoculodes* sens. str. mainly in the elongate peduncular segment 3 of antenna 1, distally narrowing propod of gnathopod 1, relatively elongate segment 5 of peraeopods 3 & 4, and shorter mandibular palp.

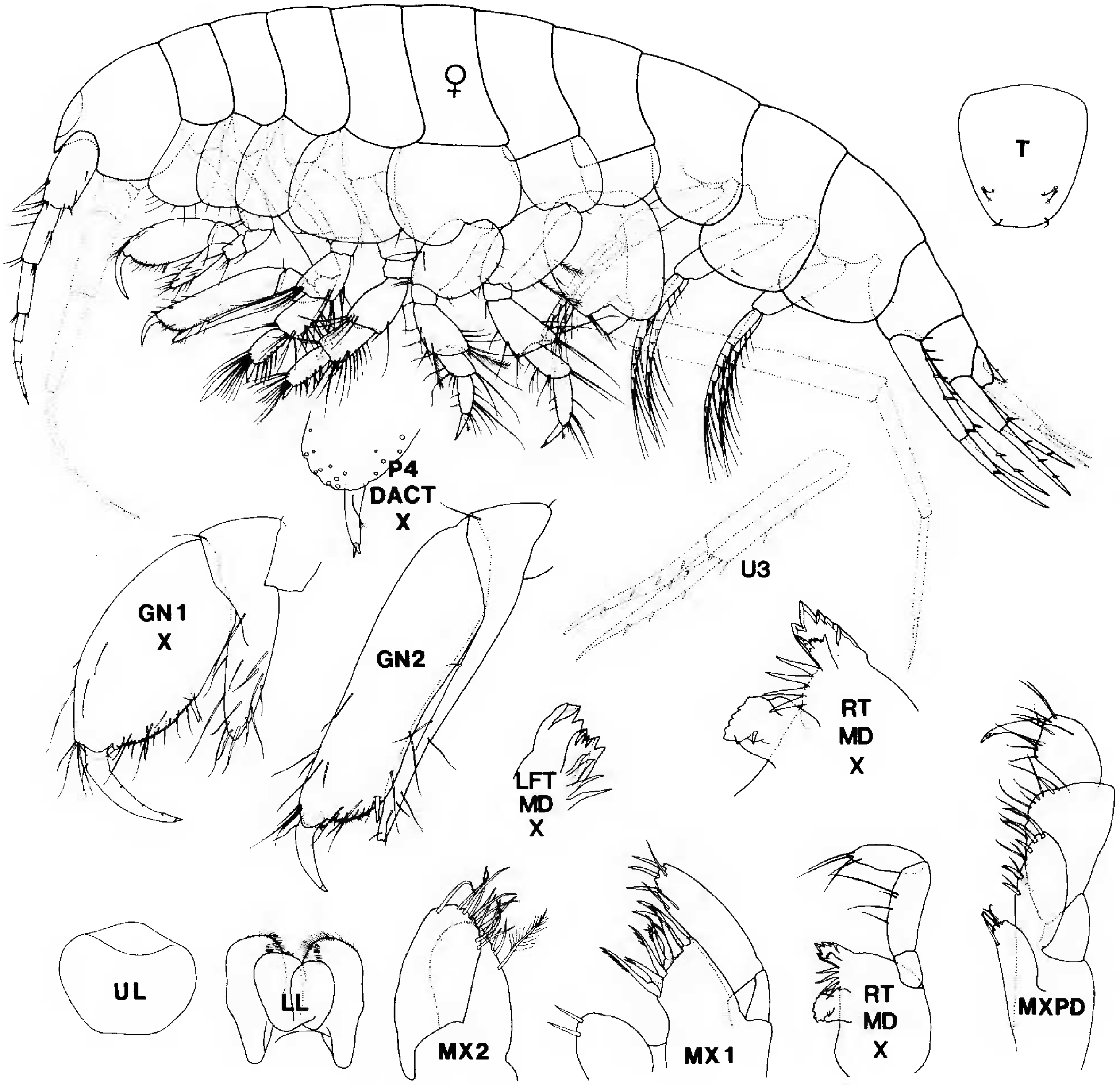

FIG. 27. ***Monoculopsis longicornis*** **(Boeck). Walrus Cove, Alaska. Female subadult (3.5 mm).**

Monoculopsis longicornis (Boeck)
(Figs. 27, 28)

Monoculodes longicornis Boeck, 1871b: 165.
Monoculopsis longicornis Sars, 1895: 311, pl. 110, fig. 1.—Stebbing, 1906: 258.—Gurjanova, 1951: 560, figs. 371A,B—Barnard & Karaman, 1991: 560.

Material examined.
ALASKA:
Mainland coast. Walrus Cove, P. Slattery coll., 1983 - 1 female subadult (3.5 mm) (**fig'd specimen**), CMN cat. no. NMC-1990-438; Ibid - 1 immature specimen, CMN cat. no. NMCC1991-323; Cape Nome, P. Slattery Stn., 1981 - 1 female subadult, NMCC1990-1543.

Diagnosis. Female (to 10.0 mm) (based on illustrations and descriptive commentary of Sars (1895), Gurjanova (1951), and Barnard & Karaman (1991), supplemented by subadult material examined (above): Antennal peduncles strongly setose.

Maxilla 1, outer plate with 8-9 apical spines.

Coxae 1 & 2, lower margins strongly setose, hind margins with 2-3 stout spines.

Gnathopods 2, propod distinctly narrowing distally; palmar margin short, finely serrulate, palmar angle with single stout spine; dactyl exceeding palm; carpal lobe narrowing to acute apex.

Peraeopods 3-6, segment 5 shorter than 4 & 6; dactyls medium to strong, chitinous rings minute. Peraeopod 7, dactyl subequal in length to segment 6.

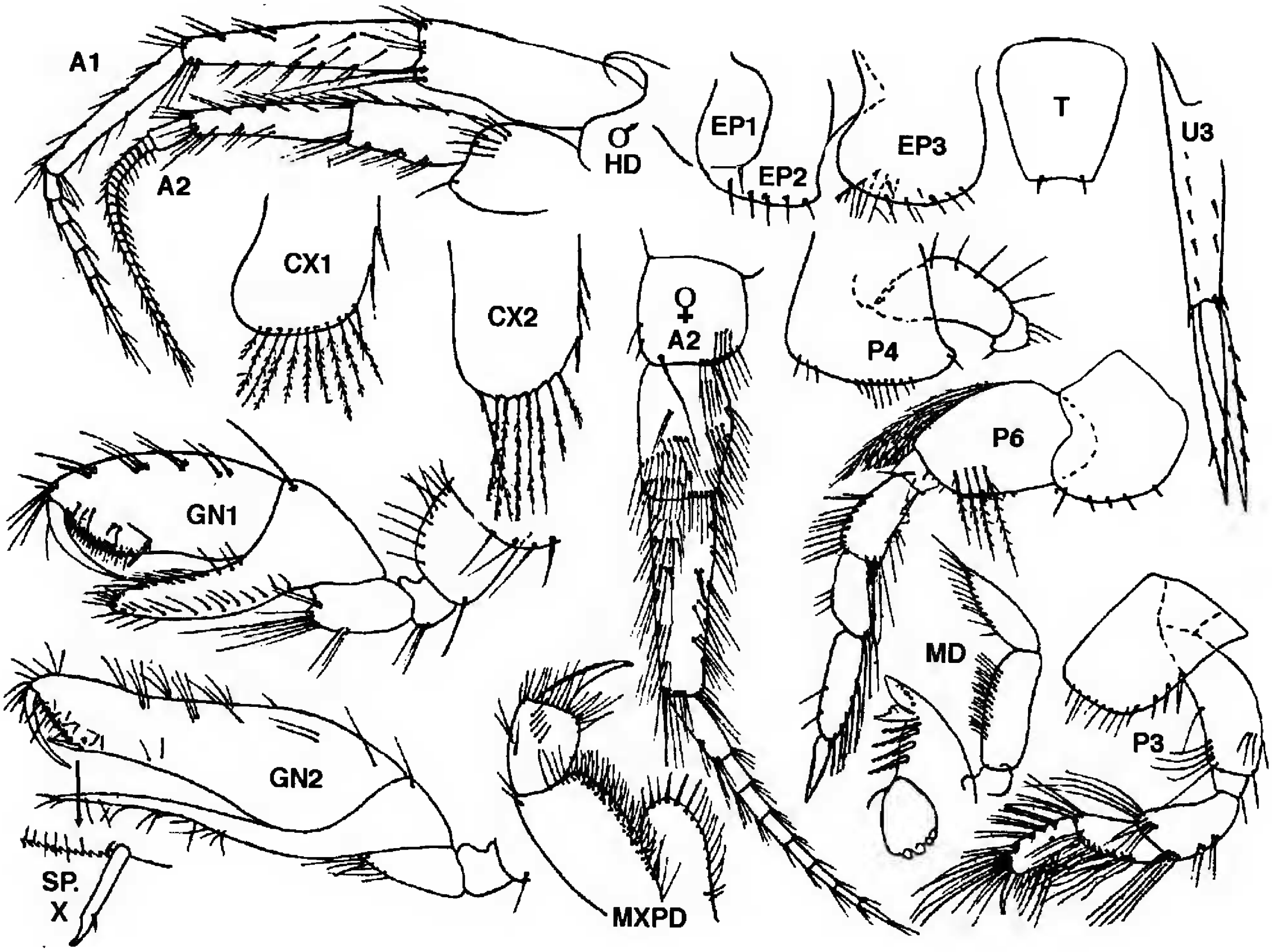

FIG. 28. ***Monoculopsis longicornis*** **Boeck. Kara Sea. Male (10.0 mm); female (10.0 mm). (after Gurjanova, 1951).**

Telson short, apical margin may be slightly indented, with 2 widely spaced setae.

Distributional ecology. A high arctic species, extending into the North Atlantic and the northern Bering Sea, in subtidal shelf depths.

Taxonomic commentary. *Monoculopsis vallentini* Stebbing, 1914, the other described species assigned to this genus, is known only from the Falkland Islands.

Synchelidium Sars (sens. lat.)

Synchelidium G. O. Sars, 1895: 317.—Stebbing, 1906: 241.—Lincoln, 1979: 344.—Ledoyer, 1993: 607.—Ishimaru, 1994. 62.

Type genus. *Synchelidium* G. O. Sars, 1895.

Genera. *Hongkongvena* Hirayama, 1992; *Chitinomandibulum* Jo, 1990; *Eochelidium*, new genus (p. 119); *Sinoediceros* Shen, 1955; *Finoculodes* J. L. Barnard, 1971; *Americhelidium*, new genus (p. 122); *Perioculodes* Sars, 1895; *Pontocrates* Boeck, 1871.

Diagnosis. (partly from keys of Barnard & Karaman 1991): Small, gnerally smooth-bodied oedicerotids having: gnathopod 2 elongate, with elongate (usually cheliform) propod, and typically subchelate gnathopod 1, in both of which the carpus is short, and the carpal lobe elongate, guarding (or fused with) the posterior margin of the propod.

Head, rostrum strong, usually deflexed distally. Pigmented eyes (rarely lacking) partially or totally on rostrum. Antennae sexually dimorphic, non calceolate; accessory flagellum lacking. Antenna 1 short (both sexes), flagellum callynophorate in male. Antenna 2, flagellum elongate in male, but peduncle segments 3-5 lacking brush setae.

Mouthparts: Upper lip simple, smooth below. Lower lip, inner lobes partly or totally fused medially. Mandibular molar reduced, apex spinose, non triturative; palp segment 3 often sexually dimorphic (short in female). Maxilliped with tendency to reduction of plates.

Peraeopods 3-6 strongly fossorial; segment 5 <segment 6; dactyls small, chitinous rings lacking. Peraeopod 7, segment 5 usually longer than segments 4 or 6.

Synchelidum G. O. Sars, restricted

Synchelidium G. O. Sars, 1895: 317.— Stebbing, 1906: 241.— Lincoln, 1979: 344.—Ledoyer, 1993: 607.
Synchelidium Sars (part), Barnard & Karaman, 1991: 566.

Type species. *Synchelidium haplocheles* Grube, 1864.

Species. S. *tenuimanum* Norman, 1895; *S. maculatum* Stebbing, 1906; *S. intermedium* G. O. Sars, 1895; *S. longidigitatum* Ruffo, 1947.

Diagnosis. Body small, slender, smooth. Head short. Rostrum medium, apex deflexed. Eye large, basal. Antennae sexually dimorphic. Antenna 1, peduncular segment 2 shorter than 1; flagellum callynophorate and more elongate in male. Antenna 2, flagellum elongate in male.

Mouthparts modified. Lower lip, inner lobes broad, separated medially. Mandible, molar small, non-triturative, usually bearing apical spine(s); left lacinia 4-dentate, right lacinia flabellate; incisor, cutting edge weakly dentate, nearly smooth; palp regularly 3-segmented, or terminal segment reduced (esp. in females). Maxilla 1, inner plate small, with single apical seta; outer plate with 8 (?) apical spines; palp slender, 2-segmented. Maxilla 2, plates small, weakly armed. Maxilliped, inner plate small, apex 2-3 setose; outer plate relatively small, weakly armed medially; palp stout, segment 2 broad; dactyl curved.

Coxa 1 small, distally broadened; coxa 4 largest, broadest distally. Gnathopod 1 strongly subchelate; propod large, broad; carpal lobe elongate, slender, proximal to (but not fused with) hind margin of propod, apex with spine, produced beyond palmar angle; palm toothed?. Gnathopod 2 narrowly chelate or cheliform; propod slender, elongate; carpal lobe very slender, completely coalesced with the propod along the entire posterior margin, apex little or not exceeding tip of dactyl.

Peraeopods 3 & 4 strongly fossorial, dactyls usually reduced. Coxa 5 deep, medium broad, shallowly aequilobate. Coxa 6 with pronounced antero-distal lobe. Peraeopods 5 & 6 strongly fossorial, 5 distinctly the smaller; dactyls usually short. Peraeopod 7 elongate; basis narrowing distally to weak posterior lobe; segments 4-7 slender, subequal in length.

Pleon plates 1-3 rounded behind. Uropods 1-3 slender, rami subequal, margins weakly spinose. Telson short, plate-like, apex slightly emarginate to rounded, weakly armed.

Coxal gills regular. Brood plates, slender, with few apical brood setae.

Distributional Ecology. Dominant in temperate coastal waters of the eastern North Atlantic and Mediterranean, and recorded (but not authenticated) form the western N. Pacific. The single record of *S. tenuimanum* Norman from the western N. Atlantic (Watling 1981) has not been authenticated. Animals burrow in fine sand and sandy mud sediments, coastal shelf to about 100 m.

Taxonomic Commentary & relationships. *Synchelidium* is an advanced genus, its character states demonstreated in the type species *Synchelidium haplocheles* (Grube, 1864 (Fig. 29). The genus *Synchelidium* overlaps in several features with the genus *Americhelidium,* represented in the geograph-ically closest species, *A. americanum* of the western North Atlantic region. Important taxonomic differences, however, are outlined the key to genera (p. 120).

Synchelidium longidigitatum Ruffo, 1947, differs markedly from all other species of *Synchelidum* and is a serious candidate for separate subgeneric, if not full generic status of its own (see key).

Eochelidium, new genus

Synchelidium (part) Kudrjaschov & Tzvetkova, 1975: 1311.—Hirayama, 1986: 357.—Hirayama, 1987: 30.—Jo, 1990: 155.—Hirayama, 1992: 150.—Ishimaru, 1994: 62.

Type species. *Synchelidium lenorostralum* Hirayama, 1986, present selection.

Species. *Eochelidium bulytschevae* (Kudrjaschov & Tzvetkova, 1975); *E. miraculum* (Imbach, 1967); *E. carinorostrum* (Jo, 1990); *E. rostriopiculum* (Hirayama, 1987); *E. nonrostrum* (Hirayama, 1992); *E. (Chitinomandibulum) emargicoxa* Jo, 1990, and *E. (C.) ampliforbicum* (Hirayama, 1992).

Diagnosis. Body (peraeon and/or pleon) smooth to dorsally rugose . Head, rostrum short to very short, strongly deflexed apically. Eyes sexually dimorphic, located wholly on rostrum, or nearly so. Antennae sexually dimorphic. Antenna 1 (female) short, little (or not) exceeding peduncle of antenna 2. Antenna 2, peduncular segment 5 longer than segment 4.

Lower lip, inner lobes fused medially or nearly so. Mandibular molar with spine and accessory setae; right lacinia bifurcate, 1 tooth serrate; left lacinia 5-dentate; palp segment 3 not shortened in female, outer and inner margins setose. Maxilla 1, outer plate with 9 apical spines. Maxilla 2, outer plate slender; inner plate lacking facial setae. Maxilliped, inner plate with 4-8 apical setae; outer plate tall, inner margin with multiple masticatory spines; palp segment 2 not broadened medially; dactyl regular, curved.

Coxa 1, hind corner produced posteriorly, setose. Gnathopod 1 subcheliform, palm finely rugose; carpus, anterior margin distinct, lobe short, not exceeding palm. Gnathopod 2 cheliform, anterior carpal margin totally fused with propod.

Coxa 4 not broadened. Peraeopods 3 & 4, segment 5 short; dactyls medium, length not (or little) exceeding segment 6. Coxa 5 deep, aequilobate. Coxa 6, anterior lobe not produced strongly below. Peraeopods 5 & 6 subsimilar in form, but peraeopod 6 larger, stronger; segment 5 shorter than 6; dactyls medium to long. Peraeopod 7, basis strongly lobate below.

KEY TO NORTH PACIFIC GENERA OF THE *SYNCHELIDIUM* GROUP

1. Peraeopod pairs 3 & 4, 5 & 6, segment 5 not shorter (usually longer) than segment 6; peraeopods 3 & 4, dactyls very short, often masked by apical setae. gnathopod 2 cheliform . . . . 2.
—Peraeopod pairs 3 & 4, 5 & 6, segment 5 distinctly shorter than segment 6; peraeopods 3 & 4, dactyls regular, length >1/3 segment 6; gnathopod 2 subcheliform (except *Eochelidium*). . . . . 4.

2. Gnathopod 2, carpal lobe variously fused to propod, line of demarcation mostly indistinct or lacking; antenna 1, peduncular segment 2 shorter than segment 1; peraeopod 6, coxa strongl.y produced antero-ventrally; maxilla 1, outer plate with 7 apical spines . . . . 3.
—Gnathopod 2, carpal lobe not fused to propod, line of demarcation distinct throughout; antenna 1, peduncular segment 2 long, >segment 1; peraeopod 6, coxa not strongly produced antero-ventrally; maxilla 1, outer plate with 9 apical spines . . . . *Pontocrates* Boeck.

3. Gnathopod 1, propodal palm strongly toothed; pleon plate 2, hind corner broadly rounded; peraeopod 7, basis lacking distinct postero-distal lobe. . . . . *Synchelidium* Sars (sens str.) (p.119).
—Gnathopod 1, propodal palmar margin smooth; pleon plate 2, hind corner squarish or acutely produced; peraeopod 7 with distinct postero-distal lobe . . . . *Americhelidum,* n. g. (p. 122).

4. Maxilla 1, outer plate with 9 apical spines; mandibular palp segment 3 with 2-5 outer marginal setae. 5.
—Maxilla 1, outer plate with 7 apical spines; mandibular palp segment 3, outer margin lacking setae (single seta rarely present). . . . . 6.

5. Mandibular right lacinia subequally bifid; coxae 3 & 4, lower margins incised; telson apically rounded; gnathopod 2, propod relatively short, chela long (~1/2 length of propod). . . . *Chitinomandibulum* Jo.
—Mandibular right lacinia unequally bfid; coxae 3 & 4 gently convex below; telson apically truncate or notched; gnathopod 2, propod elongate, chola short (>1/3 propod length . . .*Eochelidium,* n. g. (p. 119).

6. Gnathopods 1 & 2, carpus, anterior margin elongate, about equal to propod; carpal lobes short, divergent, not reaching palmar margin . . . . *Hongkongvena* Hirayama.
—Gnathopod 1 & 2, carpus, anterior margin short or indistinguishable; carpal lobes elongate, closely guarding propod, reaching to or exceeding palm . . . . 7.

7. Gnathopods 1 & 2 dissimilar in form and size; gnathopod 2, propodal palm perpendicular; mandibular palp segment 2 & 3 subequal in length; pigmented eyes lacking . . . . *Finoculodes* J. L. Barnard.
—Gnathopods 1 & 2 subsimilar, propods elongate; gnathopod 2, propodal palm oblique; mandibular palp segment 3 distinctly shorter than 2; pigmented eyes usually present . . . . 9.

8. Maxilliped, outer plate very short, not exceeding palp segment 1; dactyls of peraeopod 3 & 4 elongated, length exceeding segment 6 . . . . *Sinoediceros* Shen.
—Maxilliped, outer plate normal, reaching variously along palp segment 2; dactyls of peraeopods medium in length, not exceeding segment 6 . . . . *Perioculodes* G. O. Sars.

Pleon plate 2, hind corner obtuse, subquadratre, or weakly acute, not broadly rounded. Uropods 1 & 2, outer ramus the shorter. Uropod 3, rami subequal. Telson, apical margin straight or slightly emarginate, unarmed; penicillate setae arising distally.

Coxal gills large, elongate, lobate. Brood plates very slender, elongate, with distal marginal setae.

Etymology: Combining the Greek prefix "*eo*" meaning "dawn" (primitive) and the suffix "*chelidium*", in reference to the plesiomorphic nature of most character states of the genus.

Distributional ecology. Species of *Eochelidium* are known only from the western North Pacific region, from southern Sea of Japan to Vietnam, in shallow inshore waters. They overlap northward with *Americhelidium gurjanovae* (Kudrjaschov & Tzvetkova) and other relatively primitive species of that essentially North American Pacific genus.

Taxonomic commentary. *Eochilidium* is a primitive genus, readily separable from other members of the *Synchelidium* group by characters of the key (p.120). *Eochelidium ampliforbicum* Hirayama overlaps taxonomically with *Chitinomandibulum emargicoxa* Jo, 1990. Common character

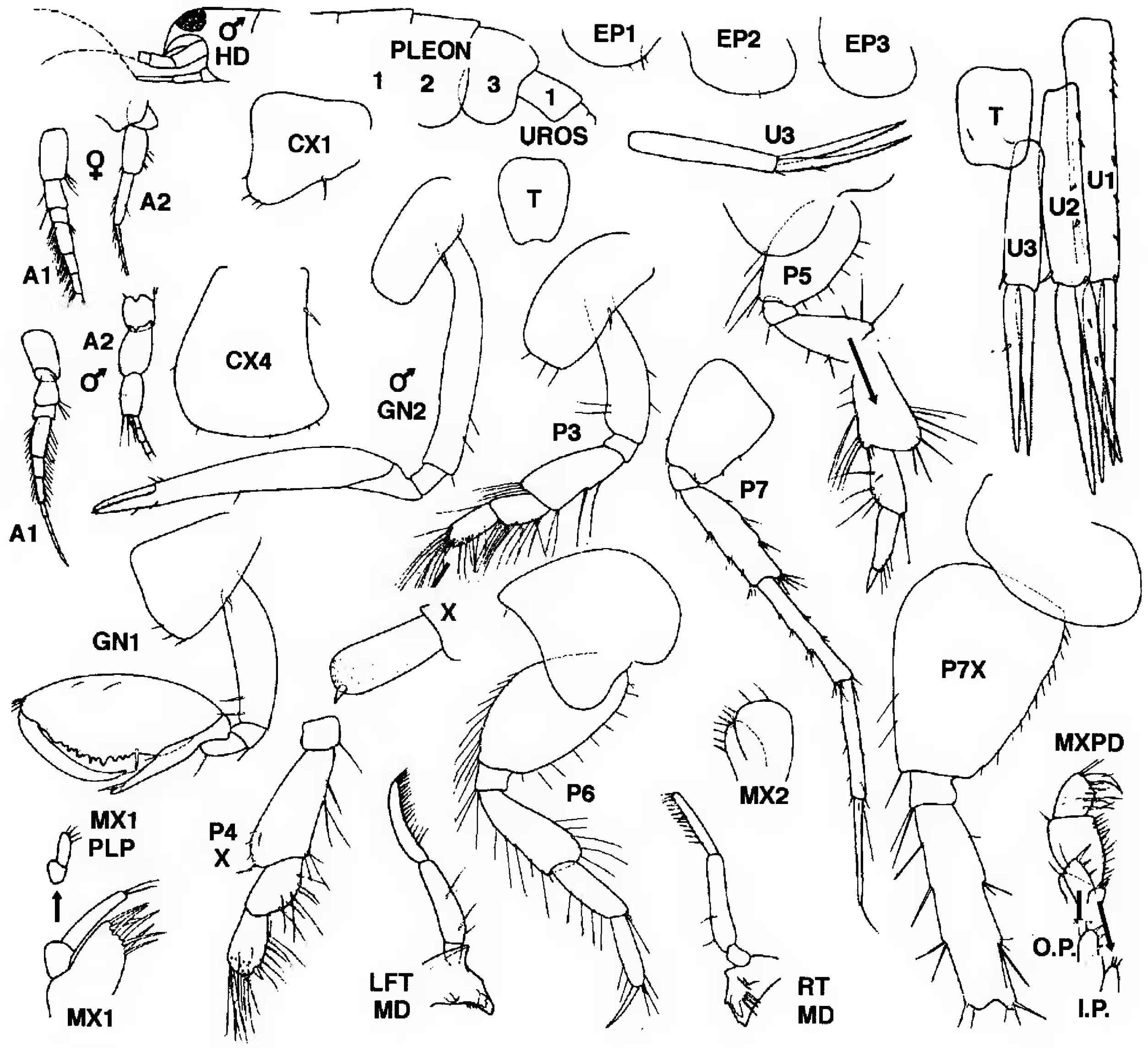

FIG. 29. *Synchelidium haplocheles* Grube, 1864. Male (2.8 mm). Mediterranean region. (after Ledoyer, 1993).

states include a bifurcate right lacinia, ventrally notched coxae 3 & 4, shallow coxa 5, short propod of gnathopod 2, weakly (or non-) lobate basis of peraeopod 7, and rounded (non-emarginate) apical margin of the telson. Such a degree of character state overlap within regional species might suggest, therefore, that the genus *Chitinomandibulum* Jo, 1990, be considered a subgenus within the genus *Eochelidium*, pending further comparative study.

Eochelidium lenorostralum (Hirayama)
(Fig. 30)

Synchelidium miraculum lenorostralum Hirayama 1986: 362, figs. 5-7.—Barnard & Karaman, 1991: 566.
Synchelidium lenorostralum Ishimaru, 1994: 62.

Taxonomic commentary. This species is closely similar to *E. miraculum* and other members of the genus from the South China Sea, in having unshortened dactyls of peraeopods 3 & 4. In this respect, members of the genus *Eochelidium* resemble *Synchelidium longidactylus* of the Mediterranean region (see Ledoyer, 1993). However, that species may require separate generic status because of its unique character states (see above, p. 119).

Eochelidium lenorostralum is fully (specifically) distinct from *S. miraculum* Imbach in which the rostrum is perpendicularly deflexed, the hind corner of pleon 2 is squared (not acute), the telson less strongly emarginate, and the mandibular palp less spinose. However, *S. lenorostralum* is distinct in its thickened maxilliped palp segment 2, and bifurcate principal molar spine.

KEY TO WESTERN NORTH PACIFIC SPECIES OF*EOCHELIDIUM* (INCL. *CHITINOMANDIBULUM*).

1. Peraeopod 7, basis, postero-distal lobe very weak, or lacking; coxa 5 shallow, width nearly twice depth; gnathopod 2;,propod relative short & stout, dactyl nearly half its length; mandible, right lacinia evenly (symmetrically) bifid . . . . *Chitinomandibulum* Jo 2.
—Peraeopod 7, basis, postero-distal lobe well-developed, covering ischium; coxa 5 nearly as deep as broad; gnathopod 2; propod relatively slender, dactyl 1/5 to 1/3 its length; mandible, right lacinia irregularly bifid or flabellate . . . .*Eochelidium* . 3.

2. Pleon plate 2 , hind corner broadly obtuse . . . . *C. ampliforbicum* (Hirayama).
—Pleon plate 2, hind corner squarish . . . . *C. emargicoxa* Jo.

3. Peraeopods 3 & 4, dactyls elongate, length < segment 6 (propod) . . . . .4.
—Peraeopods 3 & 4, dactyls relatively short, length not exceeding propod . . . . 5.

4. Pleon segments dorsolaterally ridged or carinate, surface "goose-bumped"; antenna 1, peduncular segment 2 elongate, length <segment 1. . . . . *E. nonrostrum* (Hirayama)
—Pleon segments smooth above; antenna 1, peduncular segment 2 not longer than segment 1 . . . .*E. carinorostrum* (Jo).

5. Peraeopods 3 & 4, carpus lacking posterior marginal setae . . . . *E. bulytschevae* (K. & B)
—Peraeopods 3 & 4, hind margin of carpus spinose or setose . . . . 6.

6. Coxa 3 incised below; uropods 1 & 2 rami subequal . . . . *E. nonmiraculum* (Hirayama)
—Coxa 3 gently convex below; uropods 1 & 2, outer ramus shorter than inner ramus . . . . 7.

7. Pleon 2, hind corner acute; uropods 1 & 2, rami subequal . . . . *E. lenorostralum* (Hirayama)
—Pleon 2, hind corner squarish or rounded; uropods 1 & 2, outer ramus shorter . . . . 8.

8. Rostrum very short, fused eyes at apex; peraeopods 3 & 4, propod strongly spinose posteriorly; gnathopod 2, propod very slender . . . . *E. rostriospiculum* (Hirayama)
—Rostrum regular, fused eyes subapical; peraeopods 3 & 4, propod, hind margin proximally setose; gnathopod 2, propod thicker. . . . .*E. miraculum* (Imbach)

Americhelidium, new genus

Synchelidum (part) Mills, 1962: 14.—Bousfield, 1973: 98.—Barnard, 1977: 877.—Hirayama, 1986: 357.—Barnard & Karaman, 1991: 560?

Type species. *Synchelidium spinipes* Mills, 1962 (present designation).

Species. *Americhelidium rectipalmum* (Mills, 1962); *A. gurjanovae* (Kudrjaschov & Tzvetkova, 1975); *A. latipalpum* (Hirayama, 1986); *A. micropleon* (J. L. Barnard, 1977); A. *americanum* (Bousfield, 1973); *A. millsi*, new species (p. 134); *A. pectinatum*, new species (p. 129); *A. variabilum*, new species (p. 132); *A. setosum*, new species (p. 125); A. shoemakeri (Mills, 1962).

Diagnosis. Medium to relatively large species, distinguished by the characters of the key (p. 124) and the following.

Antennae 1 & 2 sexually dimorphic. Flagella (female) subequal, short, 4-10-segmented. Antenna 1 (female), peduncular segment 2 shorter than 1.

Lower lip, inner lobes fused medially or nearly so. Mandibular palp segment 3 shorter in female, shorter than segment 2, lacking outer marginal setae; right lacinia bifid; incisor weakly toothed; molar with 1-2 spines. Maxilla 1, outer plate with 7 apical spines; palp segment 2 weakly setose. Maxilla 2, outer plate not expanded or truncate distally. Maxilliped, inner plate short, with 2-4 apical setae; outer plate short to medium, with 3-8 inner marginal spines; palp segment 2 stout.

Coxae 1-4 deep, 3 broad, 4 very broad, usually acutely produced behind. Coxa 5 deep, weakly postero-lobate; coxa 6 deep, strongly anterolobate. Gnathopods 1 & 2 dissimilar. Gnathopod 1 strongly subchelate; carpus, anterior margin short, posterior lobe slender, extending beyond palm of propod; palm of propod nearly vertical, weakly toothed. Gnathopod 2 less powerful, cheliform; anterior margin of carpus small but free, not fused to propod, carpal lobe fused to posterior margin of elongate propod, line of demarcation often visible.

Peraeopods 3 & 4, segment 5 longer than 6, dactyls very short or minute. Peraeopods 5 & 6, bases somewhat unlike in size and form, with strong median row of plumose setae; segment 5 longer than 6; dactyls very short. Peraeopod 7, basis markedly posterolobate, often with strong antero-

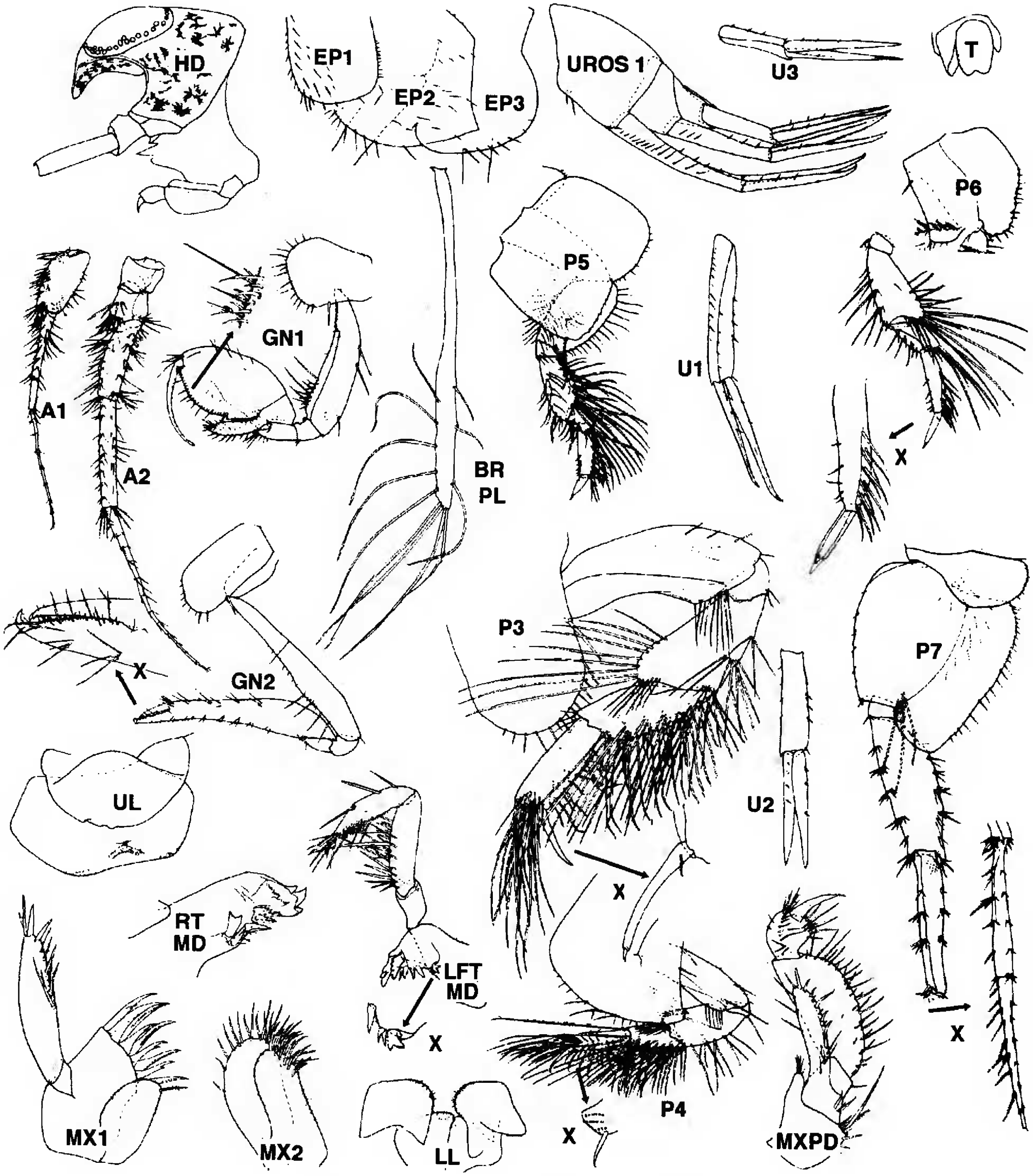

Fig. 30. ***Eochelidium lenorostralum*** **(Hirayama). Japan, northeastern shores. Female (4.75 mm). (after Hirayama, 1986)**

proximal row of short spines; dactyl elongate, margins setose and/or spinose.

Pleon plate 2, hind corner subquadrate or variously produced; pleon plate 3 subquadrate or obtuse.. Uropods 1-3, rami slender, margins weakly spinose, outer ramus generally the shorter. Telson short to medium, apex truncate or rounded, unarmed.

Coxal gills and brood plates regular.

Etymology. *Americhelidium* combines the geographical name "America" and the Greek root suffix "*chelidium*", in reference to the preponderance of North American endemic species in this cheliform oedicerotid subgroup.

Distribution: Species of *Americhelidium* occur in the

KEY TO NORTH PACIFIC SPECIES OF *AMERICHELIDIUM*

1. Coxa 4 very broad, acutely produced behind; peraeopod 6 antero-distal lobe deep, sharply rounded; gnathopod 1, palm of propod variously oblique; gnathopod 2, dactyl small, 1/4-1/6 length of propod; maxilliped outer plate short, not reaching beyond 1/2 palp segment 2 .... 2.

—Coxa 4 regular, posterior angle little produced; peraeopod 6, antero-distal lobe shallowly rounded; gnathopod 1, palm of propod perpendicular; gnathopod 2, dactyl large, ~ 1/3 length of propod; maxilliped, outer plate tall, reaching beyond !/2 palp segment 2 .... *A. rectipalmum* (Mills) (p.125)

2. Gnathopod 1, palm of propod markedly oblique; pleon plate 2, hind corner acutely produced; coxa 5, posterior lobe, lower margin nearly bare .... 3.

—Gnathopod 1, palm of propod slightly oblique; pleon plate 2, hind corner subquadrate or acuminate, not produced; coxa 5, hind lobe, lower margin variously setose .... 5.

3. Gnathopod 2, propod slender, elongate, length ~7X greatest depth; gnathopod 1, basis with strong cluster of anterior marginal setae; mandibular palp segment 2 long, greater than 1/2 palp segment 2 .... *A. millsii* n. sp. (p. 134).

—Gnathopod 2, propod medium-stout, length 5-6 X greatest depth; gnathopod 1, basis, anterior margin nearly smooth; mandibular palp segment 3 (female) short, length <1/2 segment 2 .. *A. shoemakeri* (p. 132)

4. Peraeopod 3, segment 6 relatively long, length >2 X depth; propod of gnathopod 2 short, length ~4-5 X maximum depth; mandibular palp segment 3 (female)long, length <1/2 palp segment 2; maxilliped outer plate medium; nearly reaching halfway point of palp segment 2 .... 5.

—Peraeopod 3 segment 6 very short, length ~1.5 X depth; propod of gnathopod 2 relatively long, length 5- 6 X greatest depth; mandibular palp segment 3 (female) short, length > 1/2 palp segment 2; maxilliped outer plate very short, barely reaching palp segment 2 .... 7.

5. Pleon plate 2, hind corner acute; uropod 3 regular, little (or not) exceeded by uropod 2; apical margin of telson broadly rounded; mandibular blades regular, slender .... 6.

—Pleon plate 2, hind corner obtuse; uropod 3 short, much exceeded by uropod 2; telson, apical margin sharply rounded; mandibular blades thick, stout .... *A. micropleon* (Barnard) (p. 137).

6. Peraeopod 7, basis, postero-distal lobe large, extending below ischium; maxilla 1, outer plate spines large, strongly pectinate, some extending beyond palp .... *A. pectinatum* n. sp. (p. 129)

—Peraeopod 7, basis, postero-distal lobe small, not reaching ischium; maxilla 1, outer plate, apical spines of regular form, none extending beyond apex of palp.................. *A. variabilum* n. sp. (p. 132)

7. Peraeopod 7, basis, postero-distal lobe large, extending below ischium; uropod 3, inner ramus with 1-2 marginal spines .... 8.

—Peraeopod 7, basis postero-distal lobe shallow, not extending below ischium; uropod 3, inner ramus with 3-6 marginal spines .... 9.

8. Antennae (female) short, flagellum of each shorter than peduncle; mandibular palp segment 3 large, broad, length = segment 2; western North Pacific................. *A. latipalpum* (Hirayama) (p. 128).

—Antennae relatively long, flagellum longer than peduncle; mandibular palp segment 3 short, slender, length <palp segment 2; western N. Atlantic .... *A. americanum* (Bousfield) (p. 128).

9. Coxa 1, lower margin densely setose (30-40 setae); uropod 2, inner ramus with 3-4 marginal spines; gnathopod 1, carpus, anterior margin relatively broad .... *A. setosum* n. sp. (p. 125).

—Coxa 1, margin regularly setose (10-20 setae); uropod 2, inner ramus with 6 marginal spines; gnathopod 1, carpus, anterior margin very narrow .... *A. gurjanovae* (K. & T.) (p. 128).

North Pacific coastal marine region, mainly along boreal to warm-temperate North American shores, but a few are recorded from the Asiatic Pacific shores (northern Sea of Japan), and one species from warm-temperate shores of the North American Atlantic region.

Taxonomic commentary: *Americhelidium* is closely related to the European Atlantic genus *Synchelidium* (sens. str.) but differs in a mixture of apomorphic and plesiomorphic character states listed above and in the key to genera (p. 124).

Americhelidium rectipalmum (Mills)
(Fig. 31)

Synchelidum rectipalmum Mills, 1962: 17, fig. 5.—J. L. Barnard, 1975: 363, + key, fig. 137.—Austin, 1985: 591.—Staude, 1987: 378.—Barnard & Karaman, 1991: 566.

Material Examined. ~125 specimens in 63 lots:
ALASKA: Unimak I., P. Slattery Stns. C2, C4, C22, C25, C49, C66, C67, 1982 - 16 specimens, including 4 males (to 3.5 mm) and 12 females (to 3.5 mm), CMN cat. nos. NMCC-1991-1018-1026.
Southeastern Alaska. ELB Stns., June-July, 1961: A18, A30, A57, A75, A87, A91, A92, A96, A117, A139, A175 - 22 specimens, including 1 male (**fig'd specimen**), 15 females. ELB Stns., July, 1980: S1F2, S4B1, S4B3, S4B4, S23F1 - 11 specimens, including 1 male, 1 females.

BRITISH COLUMBIA:
Queen Charlotte Islands. ELB Stns., July-August, 1957: H2, H2a, H3, H8b, H9 - 31 specimens, including 8 males, 19 females.
North-central mainland coast. ELB Stns., July, 1964: H3, H7, H21, H25, H26, H47, H52, H53, H57, H62 - 31 specimens, including 3 males, 8 females.
South-central mainland coast. ELB Stn. E4, Nov. 4, 1977 - 2 immatures.
Vancouver Island, north end. ELB Stns., July, 1959: N11, V3, V4b - 3 males, 2 females
Vancouver Island South end. ELB Stns., July, 1970: P710, P721 - 1 male, 2 females. ELB. Stns., July, 1975: P8, P13, P26, P28a - 39 specimens. ELB Stns., July 1876: B10, B20, B22, B26, B27 - 43 specimens. ELB Stns., May, 1977: B1, B6, B13 - 13 specimens.
K.E. Conlan Stn., Saanich inlet, 1975 - 1 specimen. D.V. Ellis Stns. (off James I.), 1979: 2202, 2601 - 3 specimens. G. W.O'Connell Stn. 4-B (off McCauley Pt.), 1976. - 1 male.

WASHINGTON:
ELB Stns., July, 1966: W13 (4 females, incl. **fig'd specimen**, 2 immatures); W39 (7 females). CMN coll'ections, Ottawa.

Diagnosis: Female ov. (6.0 mm). Head, rostrum short, deflexed. Fused eyes large, subapical on rostrum. Antenna relatively long, flagella 8-10 segmented.

Mandible, molar with 2 unequal apical spines; spine row with 3-4 regular blades, right lacinia broadly bifid; palp segment 3 short, weakly setose, length about half segment 2. Maxilla 1, outer plate, apical spines ordinary, not exceeding palp. Maxilliped, inner plate with 4 apical setae; outer plate tall, extending beyond half of stout palp segment 2.

Coxa 1, hind corner enlarged posteriorly, hind margin with single stout spine, lower margin strongly setose. Coxa 2, hind margin with single spine. Gnathopod 1, basis with strong antero-distal cluster of setae; propod strong, palm weakly toothed, hinge portion vertical (perpendicular to axis of propod); carpus narrow, hind lobe slender, apex with single spine, extending slightly beyond palm. Gnathopod 2, basis slender, hind margin with 1-2 long setae; propod relatively short, thick, length about 4.5 X maximum depth; dactyl strong, length ~ 1/3 propod.

Coxa 4 little broadened, hind corner acute, not strongly produced. Peraeopods 3 & 4, distal segments not exceptionally setose; length of segment 6 about 2X depth, dactyl very short. Coxa 5 medium deep, aequilobate, hind lobe weakly setose below. Coxa 6, antero-distal lobe shallow, broadly rounded. Peraeopods 5 & 6, bases subsimilar, 6 the larger; dactyls medium short. Peraeopod 7, basis regularly broadened, hind margin convex, postero-distal lobe medium, not extending beyond ischium; inner facial row of 4-5 plumose setae.

Pleon side plate 2, hind corner subquadrate; plate 3 rounded behind. Uropods 1-3, outer ramus (of each) slightly the shorter, extending equidistant posteriorly. Uropod 3, inner ramus with 4 marginal spines.

Telson relatively broad, apical margin broadly rounded, penicillate setae median.

Coxal gills and brood plates regular.

Male (3.5 mm). Antenna 1, peduncular segments 2 & 3 shorter than in female; basal flagellar segments not callynophorate, not bearing numerous aesthetascs. Antenna 2, peduncular segments 4 & 5 short, lacking anterior marginal brush setae; flagellum elongate, 40-45 segmented.

Mandibular palp segment 3, length 2/3 segment 2, inner margin with regular pectinate "D" setae.

Distributional ecology. From Unimak I., and southeastern Alaska to Lower California (+ Costa Rica?), from the low intertidal and shallow subtidal to depths of 40 m., in sand and silty sand sediments.

Taxonomic commentary. *Americhelidium rectipalmum* is a relatively primitive species, with no close relatives (Fig. 42, p. 142), possibly meriting subgeneric recognition of its own. Although ranging into the Bering Sea region, it appears less closely related to the two known Asiatic Pacific species than are *A. setosum*, and the western North Atlantic species, *A. americanum.*

The species varies in morphologically and size at maturity throughout its geographical and bathymetrical range, especially in the region of Juan de Fuca Strait.

Americhelidium setosum, new species
(Fig. 32)

Material Examined: 18 specimens, at 10 localities:
ALASKA:
Southeastern Alaska. ELB Stn. S18F3, Kamenoi Pt., Kruzof I., stones & algae on sand, 10 m., Aug. 2, 1980 - 1 female ov.

BRITISH COLUMBIA:
North-central mainland coast. ELB Stn. H23, Deadman's

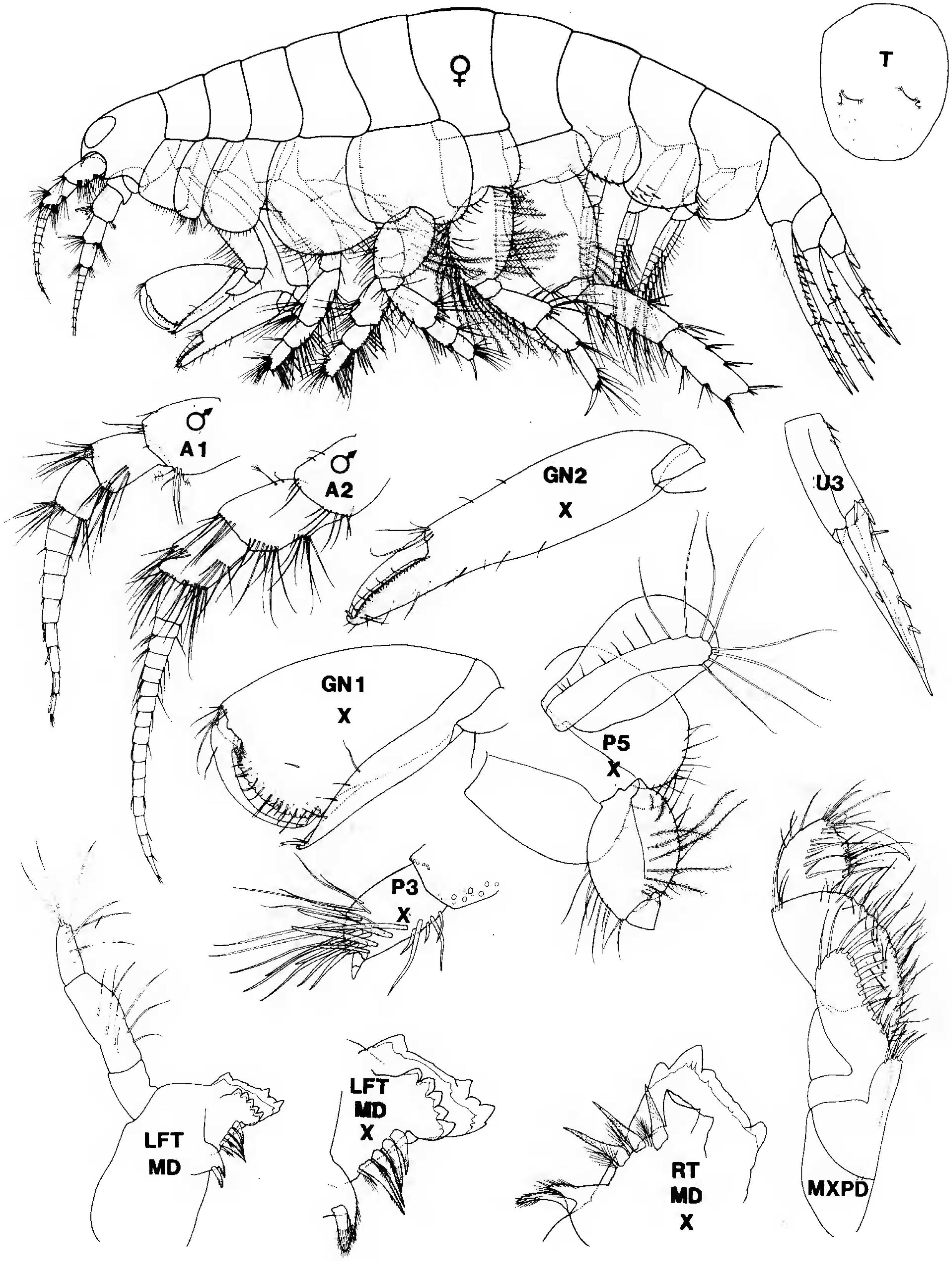

FIG. 31. *Americhelidum rectipalmum* (Mills). Neah Bay, Washington. Female (6.0 mm) Port Gravina, Alaska. Male subad. (5.0 mm).

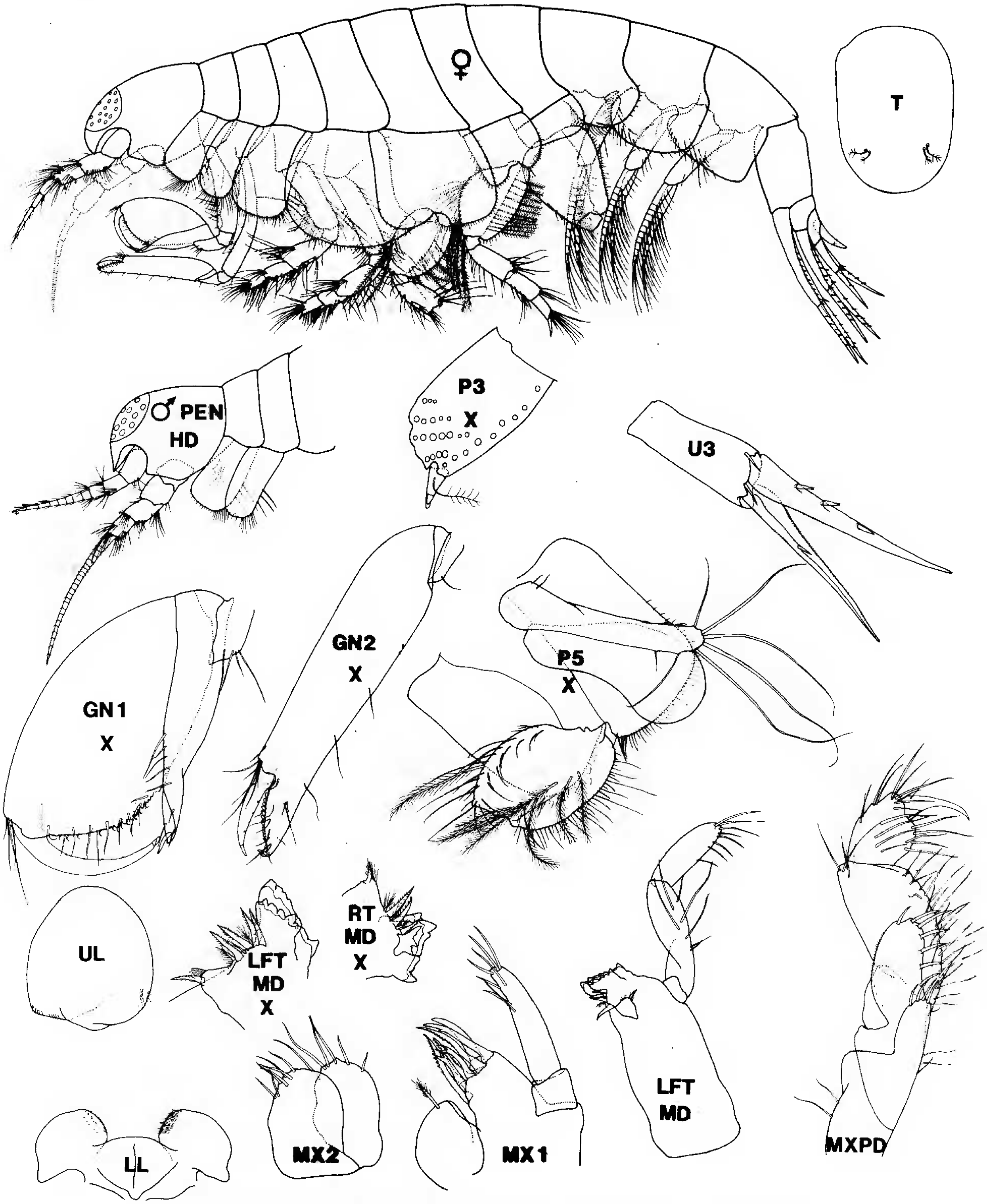

FIG. 32. ***Americhelidium setosum*, new species. Swanson Bay, B. C. Female (3.5 mm); male penult (3.0 mm).**

Cove, Banks I., fine sand, 3-5 m., July 18,1964 - 3 females. CMN cat. no. NMCC1991-0960.

Swanson Bay ($52^{o}00'$N, $128^{o}30'$ W). C. Levings Stns. A-N, April, 1973, to Nov., 1975 - female ov (3.5 mm) **Holotype;** male, penult. (3.0 mm) **Allotype.** CMN cat. no. NMCC1991-1032; 7 addition lots containing 3 males, 2 females, 7 immatures. CMN cat. nos. NMCC1990-1033 to 1039.

Diagnosis. Female ov. (3.5 mm). Head, rostrum large, strongly deflexed. Fused eyes large, fully on rostrum. Antenna relatively short, flagella 4-6 segmented.

Mandible, molar with single strong apical spine; spine row with 3-4 regular blades; right lacinia broadly trifid; palp segment 3 relatively large, distally with a few medium long setae, length about 3/4 segment 2. Maxilla 1, outer plate, apical spines relatively long but not exceeding palp. Maxilla 2, plates short, broad, weakly setose. Maxilliped, inner plate with 3 apical setae; outer plate medium, extending about half way along relatively slender palp segment 2.

Coxa 1 broad, hind corner squarish, hind margin with stout spine and several setae, lower margin strongly setose (30-40). Coxa 2 less broad, hind margin with spine and several setae. Gnathopod 1, basis with weak antero-distal cluster of setae; propod strong, slightly narrowing distally; palm steeply oblique, weakly toothed near postero-distal angle; carpus relatively broad, hind lobe narrowing, apex with single spine, extending slightly beyond palm. Gnathopod 2, basis slender, hind margin with single long setae; propod relatively short, thick, length 4.5 - 5 X maximum depth; dactyl strong, length ~ 1/4 propod.

Coxa 4 strongly broadened distally , hind corner acute, produced. Peraeopods 3 & 4, distal segments normally setose; segment 6, length about 2X depth, dactyl very short. Coxa 5 nearly as deep as coxa 4, slightly postero-lobate, hind lobe short-setose below. Coxa 6, antero-distal lobe medium, regularly rounded. Peraeopods 5, basis more broadly ovate than in peraeopod 6; dactyls medium short. Peraeopod 7, basis narrowing distally hind margin straight, short-setose, postero-distal lobe medium, not extending beyond ischium.

Pleon side plates 2 & 3, hind corners squared. Uropods 1-3, outer ramus (of each) distinctly the shorter, those of uropods 1 & 2 exceeding uropod 3. Uropod 3, inner ramus with 3 marginal spines.

Telson medium broad, apical margin broadly rounded, penicillate setae distal.

Coxal gills and brood plates regular.

Penultimate male (3.0 mm). Antenna 1, peduncular segments 2 & 3 shorter and less setose than in female; flagellum 7-segmented. Antenna 2, metamorphosing flagellum 20+ segmented.

Mandibular palp segment 3 as in female.

Etymology. From the Latin "*setosus*" - hairy, in reference to the strongly setose lower margin of coxa 1.

Distributional Ecology. From the Sitka region, southeastern Alaska, to central British Columbia, on sandy mud bottoms, from the low water level to depths of 52 m., in temperatures of 5.9-7.^{0}C., and salinities of 31.6 to 33.4‰.

Taxonomic commentary. *Americhelidium setosum* is a relatively primitive species, closely allied to *A. americanum* of the western North Atlantic and to *A. gurjanovae* and *A. latipalpum* of the Sea of Japan (Fig. 42, p. 142). These species are similar in having a single strong apical molar spine, but the inner lobes of the lower lip are less closely fused medially in *A. americanum.*

Asiatic North Pacific species of *Americhelidium*

Two western North Pacific species of the *Synchelidium* group are referable to *Americhelidium*, outlined above, viz. *A. gurjanovae* (Kudrjaschov & Tzvetkova, 1975) and *A. latipalpum* (Hirayama, 1986). Both occur in northern parts of the Sea of Japan, along shallow sandy shores.

Americhelidium gurjanovae Kudrjaschov & Tzvetkova
(Fig. 33)

Synchelidium gurjanovae Kudrjaschov & Tzvetkova, 1975: 1311, fig. 3A.—Barnard & Karaman, 1991: 566.

Taxonomic commentary: *Americhelidium gurjanovae* was described and figured originally from fairly extensive material in the northern Sea of Japan (Peter-the-Great Bay and S. Sakhalin), to depths of 50 m. Descriptive data and figures leave little doubt that the species is referable to *Americhelidium* rather than to the regionally endemic genus *Eochelidium.* Among the few differences, the anterior margin of gnathopod 2 is shown fused to propod; the inner lobes of the lower lip are fused totally; and the dactyls of peraeopods 5 & 6 are medium in length.

Americhelidium latipalpum (Hirayama)
(Fig. 34)

Synchelidium americanum latipalpum Hirayama, 1986: 357, figs. 1-4.—Barnard & Karaman, 1991: 566.—Ishimaru, 1994: 62.

Taxonomic commentary: Hirayama (1986) initially and perceptively described this taxon as a subspecies of *Synchelidium americanum* Bousfield, 1973. This form is clearly referable to genus *Americhelidium* in nearly all its diagnostic generic character states, but differs (probably) in lacking a reduced mandibular palp 3 in the female. Differences between the two species noted by Hirayama (loc. cit.) viz., in apical spination of the mandibular molar, size and breadth of mandibular palp segment 3, breadth of coxa 4, and shape of the telson, are here considered of species level significance.

A.merichelidium latipalpum is close to *A. gurjanovae* but differs in characters of the key (p. 124).

Americhelidium americanus (Bousfield)

Synchelidium americanum Bousfield, 1973: 98 , pl.XX, fig. 1.—Hirayama, 1986: 357.—Barnard & Karaman, 1991: 566.

Taxonomic commentary. *Americhelidium americanum* is the only species of syncheliid yet recorded from the western North Atlantic region. Although showing some character states of *Synchelidum*, sens str., it is most closely allied with the relatively primitive *A. setosum* - *A. gurjanovae* complex of the North Pacific region (Fig. 42, p. 142).

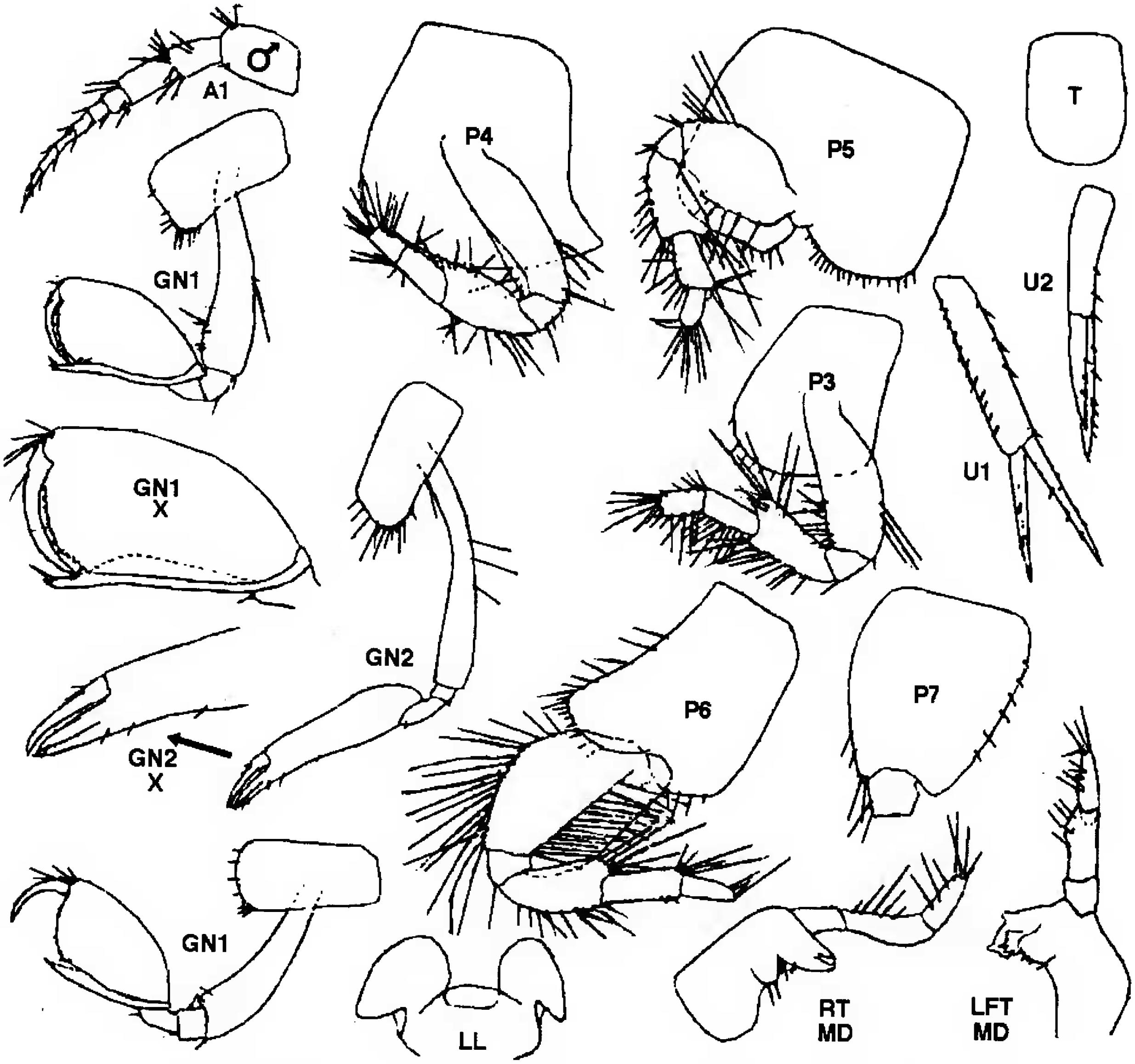

FIG. 33. ***Americhelidium gurjanovae*** **(Kudrjaschov & Tzvetkova). South Sakhalin I. Female (4.0 mm); male (3.0 mm) (after Kudrjaschov & Tzvetkova, 1975).**

Americhelidium pectinatum, new species
(Fig. 35)

Material examined. About 500 specimens in 12 station lots, mostly from one locality on the outer coast of Washington
BRITISH COLUMBIA:
North-central mainland coast. ELB Stn. H59 (off Bolivar I.) fine white and, 15 m. - 1 female ?).
Southern Vancouver Island. ELB Stn. P703 (McKenzie Beach), July 7, 1970 - 1 female.
ELB Stn P21b (McKenzie Beach), fine sand, 44-50 m., Aug. 9, 1975 - 1 immature specimen.

WASHINGTON:
ELB Stns., July, 1966: W8, W18, W20, W22, W24, W34, W40, W46 - ~460 specimens, including males, females, immatures: Type material from W18 (Cape Shoalwater) includes: female ov. (4.0 mm) **Holotype,** CMN Cat. no. NMCC 1990-0503; W46 Leadbetter Pt. - male (3.0 mm) **Allotype**, CMN cat. no. NMCC1990-0508.

Diagnosis. Female ov. (4.0 mm). Head, rostrum medium large, deflexed. Fused eyes large, fully on rostrum. Antenna relatively long, flagella 7-8 segmented.

Mandible, molar with 2 unequal apical spines; spine row with 4 regular blades, right lacinia broadly bifid; palp segment 3 short, with long inner margin and apical setae. Maxilla 1, outer plate, apical spines slender, distally strongly pectinate, some spines exceeding palp. Maxilla 2, plates apically weakly setose. Maxilliped, inner plate with 2 apical setae; outer plate very short, extending little beyond palp segment 1; palp segment 2 short, stout.

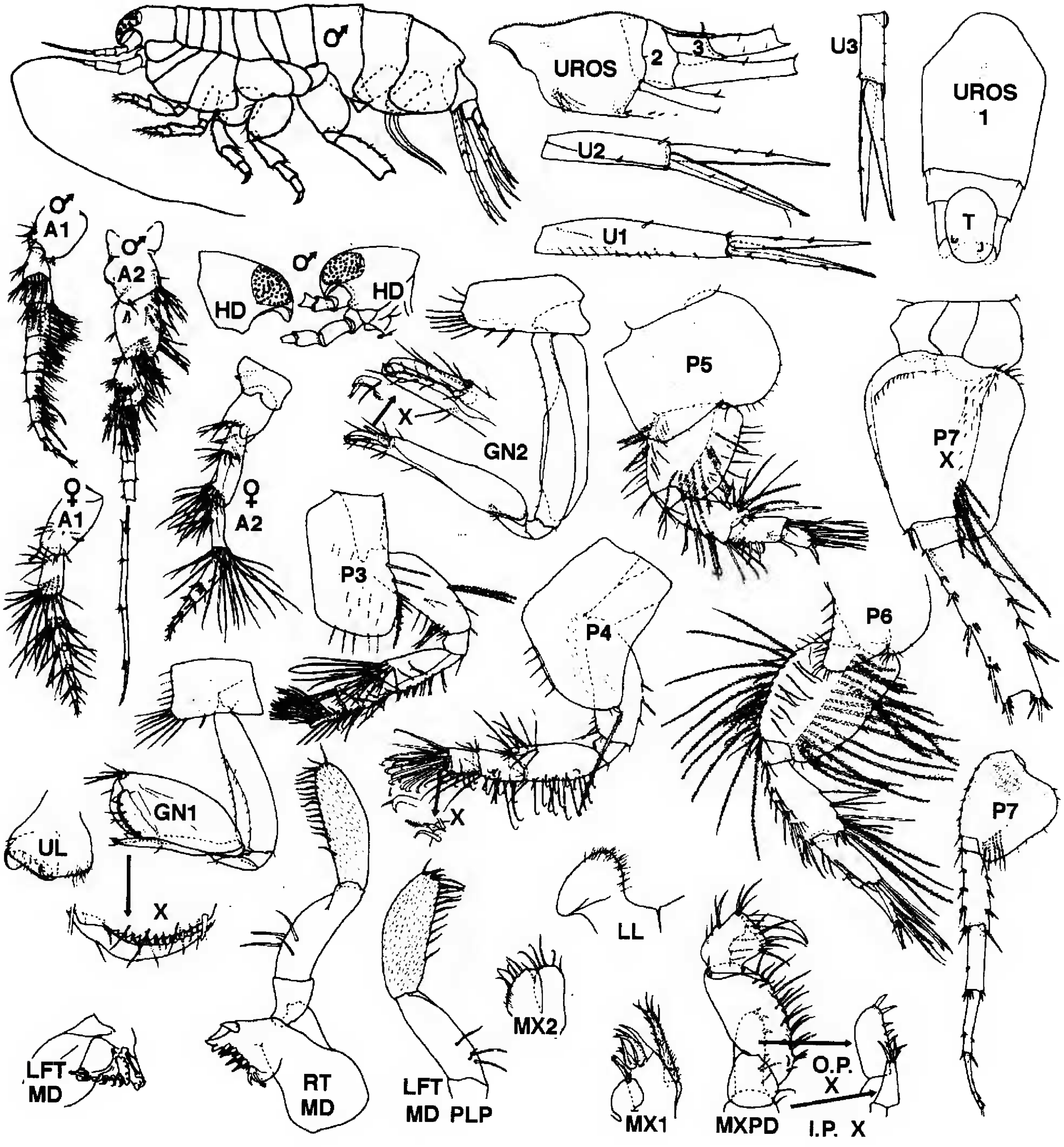

FIG. 34. ***Americhelidium latipalpum*** **(Hirayama). Otsuchi Bay, Japan. Male (2.76 mm); female (3.5 mm). (after Hirayama, 1986).**

Coxa 1, medium broad, rectangular, hind margin with stout spine and a few setae, lower margin moderately setose. Coxa 2 narrow, hind margin with 3 spines. Gnathopod 1, basis with weak antero-distal cluster of setae; propod strong, broadening distally; palm weakly denticulate, steeply oblique; carpus narrow, hind lobe slender, apex with single spine, extending beyond palm. Gnathopod 2, basis slender, hind margin with 3-4 long setae; propod medium, length ~5X maximum depth; dactyl medium, length ~ 1/5 propod.

Coxa 4 moderately broadened distally, hind corner acute, produced, not upturned. Peraeopods 3 & 4, distal segments strongly setose; segment 6 short, length little greater than depth; dactyl minute. Coxa 5 large, very broad, nearly as deep as coxa 4, aequilobate, hind lobe strongly short-setose below. Coxa 6, antero-distal lobe strong, regularly rounded. Peraeopods 5 & 6, bases subsimilar, 6 the larger; dactyls medium short. Peraeopod 7, basis narrowing slightly distally, to deep postero-distal lobe that extends beyond ischium, hind margin slightly convex; inner face with strong antero-proximal setal "comb-row", and distal median row of 5-7 plumose setae.

Pleon side plates 2 & 3, hind corners subquadrate.

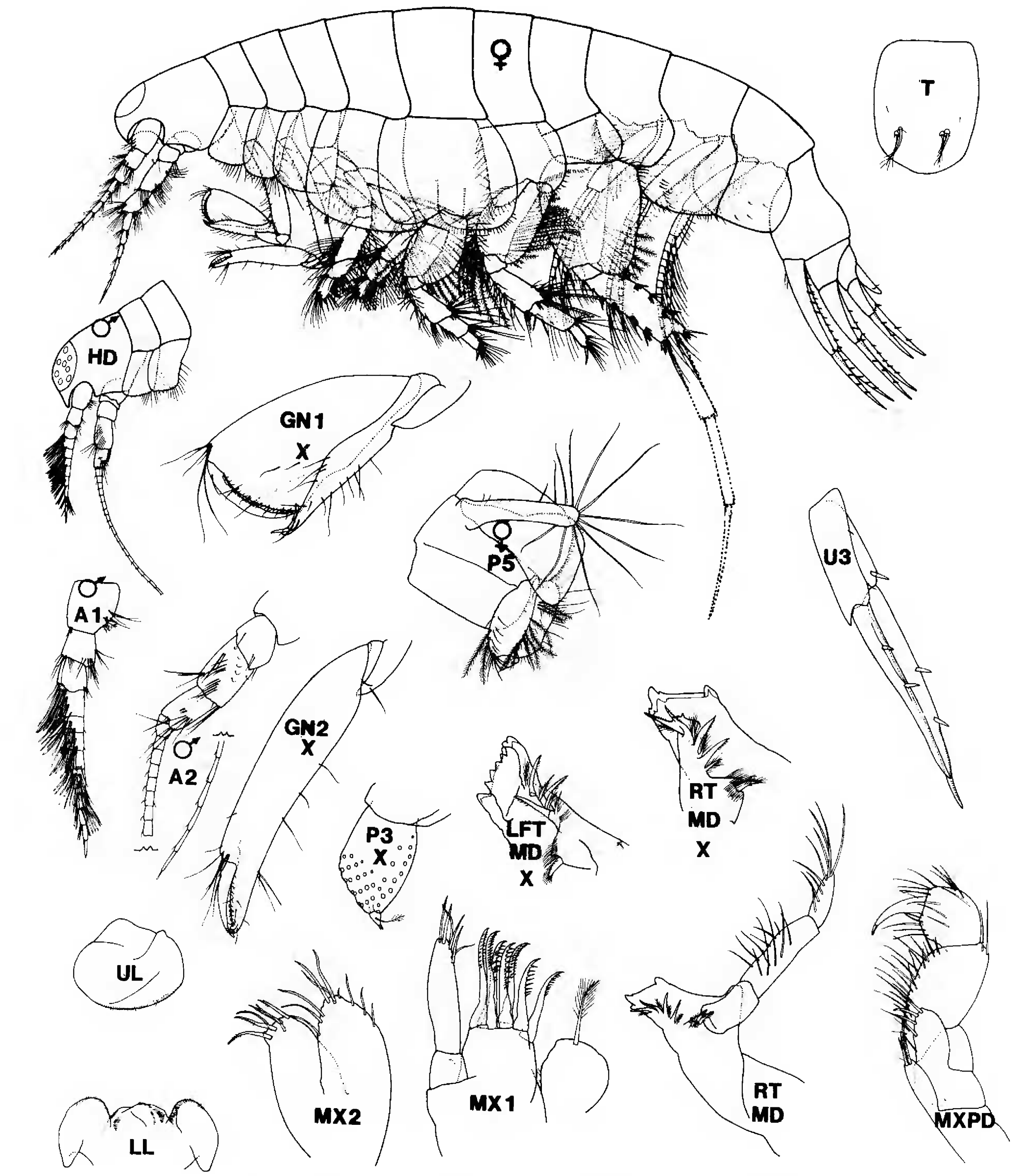

Fig. 35. ***Americhelidium pectinatum*, new species. Leadbetter Pt., Washington. Female (4.0 mm). Cape Shoalwater, Washington. Male (3.0 mm).**

Uropods 1-3, outer ramus (of each) slightly the shorter, those of uropod 2 extending furthest posteriorly. Uropod 3, inner and outer ramus each with 2 marginal spines.

Telson subrectangular, apical margin rounded, penicillate setae distal.

Coxal gills relatively large, broadest distally. Brood plates relatively short, with 10-12 apical setae.

Male (3.0 mm). Antenna 1, peduncular segments 2 & 3 slightly shorter than in female; flagellum 9-segmented, basal segments callynophorate but not fused, bearing numerous aesthetascs. Antenna 2, peduncular segments 4 & 5 shorter than in female, lacking anterior marginal brush setae; flagellum relatively short, 20-25 segmented.

Mandibular palp segment 3 regular, length 2/3 segment 2, inner margin with pectinate "D" setae.

Etymology. The species name is derived from the Latin "pectinatus"- comblike, with reference to the long comblike spines of the outer plate of maxilla 1.

Distributional Ecology. From central British Columbia, southward to Washington, and possibly northern Oregon, in sandy substrata of open ocean beaches, subtidally to 50 m. Its distribution may parallel that of the open beach burrowing talitroidean, *Proboscinotus loquax* (Barnard), the distribution of which is also narrowly centred, on the open beaches of Washington state.

Taxonomic commentary. *Americhelidum pectinatum* is a moderatley advanced species of the genus, closely related to *A. variabilum* and *A. micropleon* (Fig. 42, p. 142).

Americhelidium variabilum, new species

(Fig. 36)

Material Examined: 20+ specimens from 6+ localities in British Columbia and Washington state, as follows:
BRITISH COLUMBIA:
North-central mainland coast. ELB Stn. H37, Open Bight, Queen Charlotte Sound, fine sand, 50-70 m., July 22, 1964 - 2 females; H49 (Goose I. Anchorage), fine sand, 15 m. - 2 penultimate males, 3 females, 7 immatures, CMN cat. no. NMCC1991-0969.
Vancouver Island, south end. ELB Stn. B10c (off Brady's Beach), sand, 10 m., June 28, 1976 - female (3.2 mm) (var.) ELB Stn. P1 (Pilot Cove), 44 m., Nov. 2, 1977 - 1 female (2.8 mm) (variant)).
K.E. Conlan Stns. (Saanich Inlet), 1976 - several females.

WASHINGTON:
ELB. Stn. W39 (Neah Bay, Clallam Co.) east boat slip, medium coarse sand and sandy mud at LW, July 30, 1966 - 1 female ov. (3.0 mm) **Holotype**; 1 female subadult **Paratype,** CMN cat. no. NMCC1991-0914.

Diagnosis: Female ov. (3.0 mm). Head, rostrum medium, little deflexed. Fused eyes medium, partly on rostrum. Antenna relatively short, flagella 5-6 segmented.

Mandible, molar with single stout apical spine; spine row with 4 regular blades; right lacinia broadly bifid; palp segment 3 very short, with single terminal seta, length about 1/3 segment 2. Maxilla 1, outer plate, apical spines ordinary, not exceeding palp. Maxilla 2, plates not broadened, weakly setose apically. Maxilliped, inner plate with 2 apical setae; outer plate short, not attaining mid-point of very stout palp segment 2.

Coxa 1 subrectangular, hind margin with 1-2 spines, lower margin regularly setose. Coxa 2, hind margin with 3 spines. Gnathopod 1, basis sparsely with antero-distal marginal setae; propod relatively slender, palm medium short, weakly toothed, steeply oblique; carpus medium, hind lobe slender, apex with single spine, extending slightly beyond palm. Gnathopod 2, basis slender, hind margin with single long setae; propod slender, about 6X maximum depth, lower margin weakly concave, sparsely setose; dactyl short, length ~ 1/6 propod.

Coxa 4 strongly broadened, hind corner acute, not strongly produced. Peraeopods 3 & 4, distal segments regularly setose; segment 6 short, length little greater than depth; dactyl minute. Coxa 5 broad, medium deep, weakly postero-lobate, hind lobe nearly bare below. Coxa 6, antero-distal lobe strong, deep apex sharply rounded. Peraeopods 5 & 6, bases subsimilar, 6 much the larger; dactyls medium short. Peraeopod 7, basis proximally very broadened, narrowing distally to shallow postero-distal lobe, hind margin nearly straight, inner face lacking antero-proximal arc of spines, distally with 2-3 submarginal plumose setae.

Pleon side plate 2, hind corner acute, not produced; plate 3 rounded behind. Uropods 1 & 2, rami extending beyond uropod 3, outer ramus of 2 slightly the shorter. Uropod 3, rami subequal, inner ramus with 2, and outer ramus with 1, marginal spines.

Telson medium narrowing distally, apical margin rounded, penicillate setae distal.

Coxal gills narrowly sac-like. Brood plates relatively short, apices with 6-8 setae.

Mature male unknown.

Etymology: From the Latin "variabilus" - varied, with reference to the variable taxonomic characters, especially of the coxal plates and gnathopod 1 exhibited within the few populations of this study series.

Distributional Ecology. From northern British Columbia to Washington state, subtidally in fine sand to depths of 70 m.

Taxonomic commentary. *Americhelidium variabilum* is most closely related to the advanced North American Pacific endemic *A. pectinatum* and *A. micropleon* (Fig. 42, p. 142). Some morphological variation was noted. In material from Pilot Cove, B. C., the carpal lobe of gnathopod 1 extends well past the palmar postero-distal angle but the postero-distal process of coxa 4 is scarcely at all produced. In gnathopod 1 of material from Neah Bay, the coxa has 3 posterior marginal spines, the propodal palm is more oblique, but the carpal lobe less elongate.

Americhelidium shoemakeri (Mills)

(Fig. 37)

Synchelidium shoemakeri Mills 1962: 15, fig. 4.—Barnard, 1969b:195.—Barnard, 1975: 363, fig. 136.—Austin, 1985: 591.—Staude, 1987: 378.—Barnard & Karaman, 1991: 566.

Material Examined:
ALASKA:
Aleutian Islands. Unimak I., P. Slattery Stns., C40, C42 C112, C115 - 8 specimens, including female (4.0 mm).
Alaska mainland. P. Slattery Stn., 30 miles west of Cape

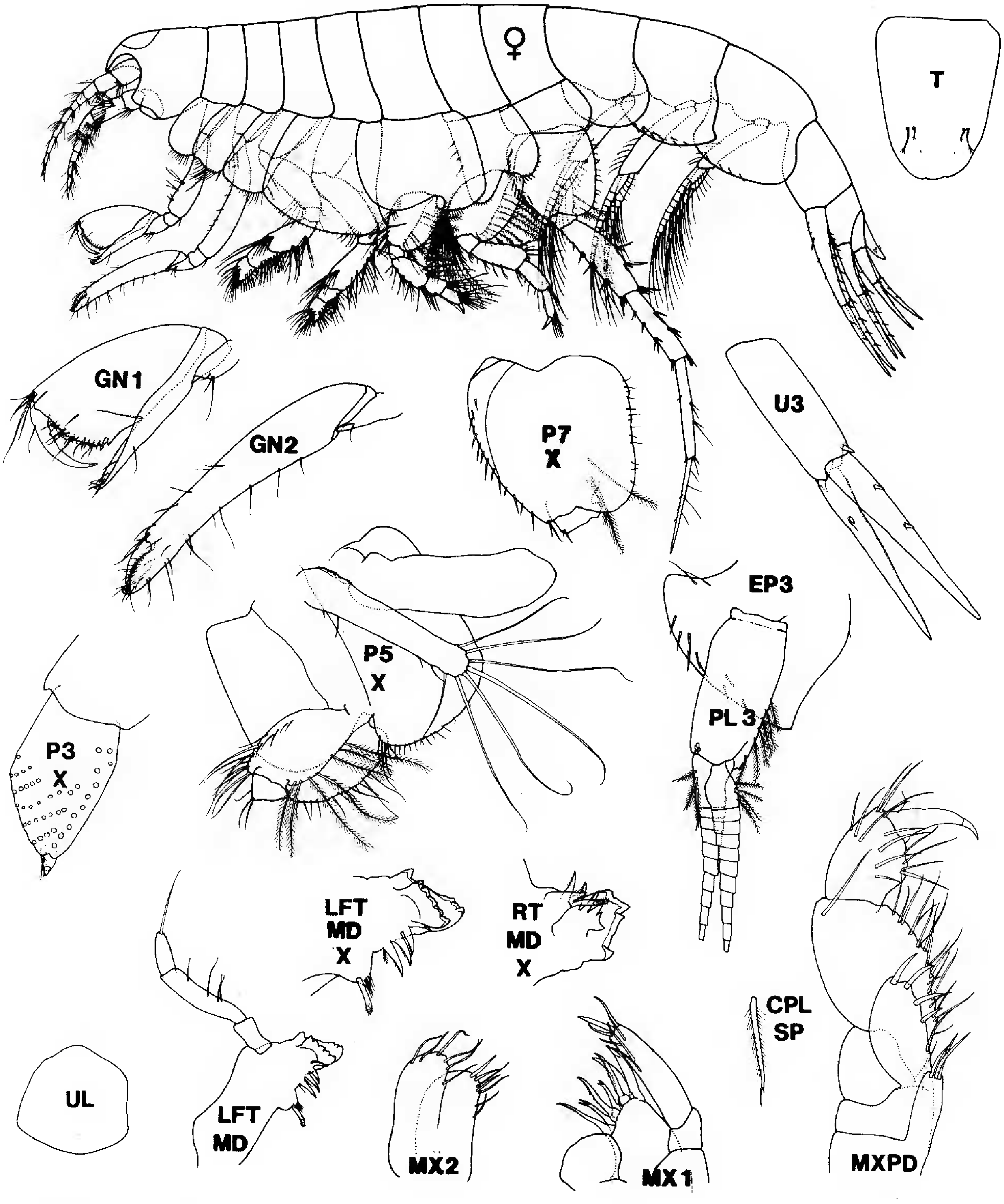

FIG. 36. ***Americhelidium variabilum*, new species. Neah Bay, Washington. Female ov. (3.0 mm)**

Rodney, Dive 5, 1981 - 1 male, 1 female, 3 immatures.
Southeastern Alaska. ELB Stns., July-Aug., 1961: A42, A175 - 5 females in 2 size classes.
ELB Stns., July, 1980: S1F2, S5B3, S8B1, S11B4, S18B3, S18F1, S18F2, S18 F2 - 47 males, females and immatures.

BRITISH COLUMBIA:
Queen Charlotte Islands. ELB Stn. W9 (Gudal Bay), July 26, 1957 - 1 female.
North-central mainland coast. ELB Stns., July, 1964: H7, H10, H13, H22, H23, H48, H50, H53, H57 - 240 males, females, and immatures.
Vancouver Island, north end. ELB Stns., July, 1959: V3, V7, V22, V17, O5, O7a, O7b, O13 - 30 specimens (incl. male and female holotype and paratype specimens of Mills, 1962).
Vancouver Island, south end. ELB Stns, July-August, 1955:

F1, F3, F5 - 17 specimens.
ELB Stns.,1964: H43 (Witty's lagoon), sand at LW, July 28 - 529 females, 32 males, 11 immatures, including female (4.5 mm) and male (2.4 mm) (**fig'd specimens**), CMN cat. no. NMCC1991-0965; H44 (Brady's Beach), fine white sand at LW, July 29 - 12 specimens.
ELB Stns., July, 1970: P703, P708, P710, P716, P717, P715 - ~350 specimens.
ELB Stns., July, 1975: P14a, P29b, P29c - 26 specimens.
ELB Stns., June, 1976: B4, B27 - 43 specimens.
ELB Stns., May, 1977: B1, B5b, B6b, B8, B13, B14 - 196 specimens (specimens at B14 photographed).
K E Conlan Stns., Saanich Inlet, 1975: 7 stations near Mill Bay - 21 specimens.

WASHINGTON:
ELB Stns., July, 1966: W2, W7, W8, W20, W31, W33, W36, W39, W42 - ~200 males, females, immatures, including small variety at Stn. W8.

OREGON:
ELB Stns., August, 1966: W63, W64 - 3 specimens.
CMN collections, Ottawa.

Diagnosis: Female ov. (3.5 - 4.5 mm). Head, rostrum short, deflexed. Fused eyes large, fully on rostrum. Antenna medium, flagella 5-6-segmented.

Mandible, molar with 2 very unequal apical spines; spine row with 4 regular blades, right lacinia small; spine-like; left lacinia irregularly 5-7 dentate; palp segment 3 short, weakly long-setose, length ~1/2 segment 2. Maxilla 1, outer plate, apical spines slender, tips level with apex of palp. Maxilla 2, inner plate distally narrowing, apex strongly setose. Maxilliped, inner plate with 2 apical setae; outer plate short, not reaching half way along medium stout palp segment 2.

Coxa 1, not broadened hind margin with 2-3 spines, lower margin weakly setose. Coxa 2 narrow, hind margin with 5-6 unequal spines. Gnathopod 1, basis antero-distally nearly bare of setae; propod strong, relatively slender; palm regularly oblique, virtually smooth, carpus narrow, hind lobe slender, apex with single spine, extending slightly beyond palm. Gnathopod 2, basis slender, hind margin with 1-2 long setae; propod medium, length 5-6 X maximum depth; dactyl medium, length ~ 1/5 propod.

Coxa 4 strongly broadened distally, hind corner acute, strongly produced, upturned apically. Peraeopods 3 & 4, distal segments regularly setose; segment 6 short, narrowing distally, dactyl minute. Coxa 5 very large, as deep as coxa 4, slightly posterolobate, hind lobe nearly bare below. Coxa 6, antero-distal lobe medium strong, apex regularly rounded. Peraeopods 5 & 6, bases subsimilar, 6 the larger; with stronger postero-proximal lobe; dactyls short. Peraeopod 7, basis broad, hind margin convex, postero-distal lobe medium, barely reaching distal margin of ischium; inner facial row of 4-5 plumose setae.

Pleon side plate 2, hind corner acute, produced; plate 3, hind corner obtuse. Uropods 1& 3, rami very slightly unequal. Uropod 2, rami relatively long, outer ramus distinctly the shorter; all rami extending equidistant posteriorly. Uropod 3, inner ramus with 42 marginal spines; outer ramus smooth.

Telson narrowing distally, apical margin regularly rounded, penicillate setae distal.

Coxal gills relatively short, sac-like. Brood plate on peraeopod 5 with 10 long apical setae.

Male (2.4 - 3.5 mm). Antenna 1, peduncular segments 2 & 3 shorter and less setose than in female; basal flagellum 7-8 segmented, basally callynophorate but not fused, bearing numerous aesthetascs. Antenna 2, peduncular segments 4 & 5 short, lacking anterior marginal brush setae; flagellum very elongate, with 50-60 segments.

Mandibular palp segment 3, length 3/4 segment 2, inner margin with regular pectinate "D" setae.

Distributional ecology: From Unimak I, and south-eastern Alaska, through British Columbia, Washington and Oregon to the central California coast, on sandand fine sand bottoms, from the shoreline subtidally to about 70 m.

Taxonomic Commentary. *Americhelidium shoemakeri* is the most common species on the Pacific coast of North America. It is not closely related to any species but is least different from *A. millsi* (Fig. 42, p. 142).

This species varies considerably, in morphology and size at maturity, throughout is geographical and bathymetrical range. The degree of variation was not considered of species significance in this investigation, but further study may indicate otherwise.

Americhelidium millsi, new species
(Fig. 38)

Material Examined.
WASHINGTON
ELB Stns., July, 1966: W33 (Crescent Beach) - 1 male (4.2 mm), 4 females ov., NMCC1991-0991; W35 (Agate Beach) muddy sand at LW - 1 female, NMCC1991-0356; W39 (Neah Bay, at east boat slip), medium coarse sand, muddy sand at LW level, July 30 - female ov (5.5 mm) **Holotype**; male (4.2 mm) **Allotype**; 1 male **Paratype**; CMN cat no. NMCC1991-0094.

Diagnosis. Female ov. (5.5 mm). Head, rostrum medium, deflexed. Fused eyes medium, fully on rostrum. Antenna medium, flagella 5-8 segmented.

Mandible, molar with 2 unequal apical spines; spine row with 2-3 regular blades; right lacinia narrowly bifid; palp segment 3 medium, apex and inner margin with long setose, length ~2/3 segment 2. Maxilla 1, outer plate, apical spines ordinary, not exceeding distally narrowing palp. Maxilla 2, , outer plate narrow, apically 6-7 setose. Maxilliped, inner plate with 3-4 apical setae; outer plate short, not attaining

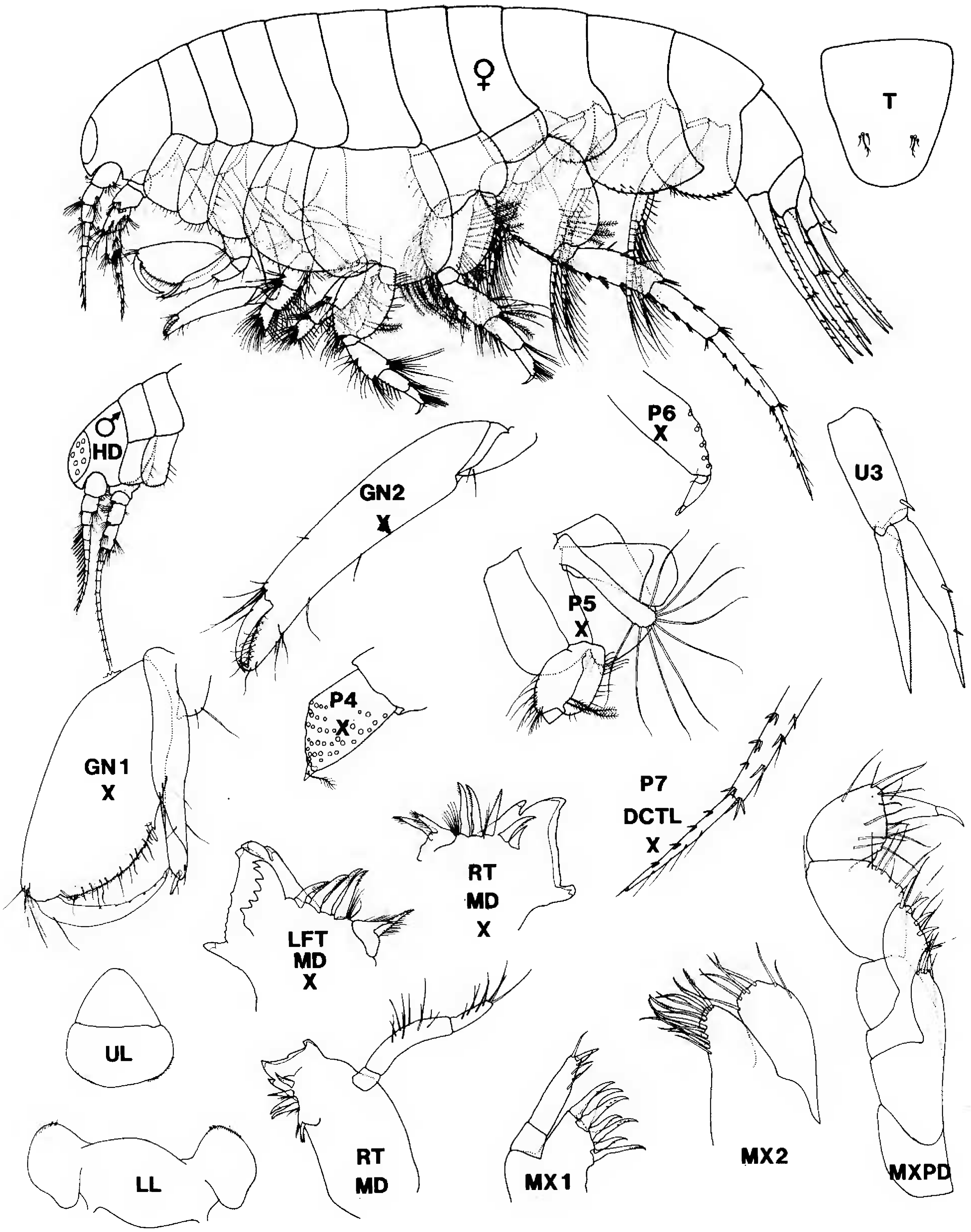

FIG. 37. *Americhelidium shoemakeri* (Mills). Witty's Lagoon, Vancouver I., B. C. Female (4.5 mm); male (2.4 mm).

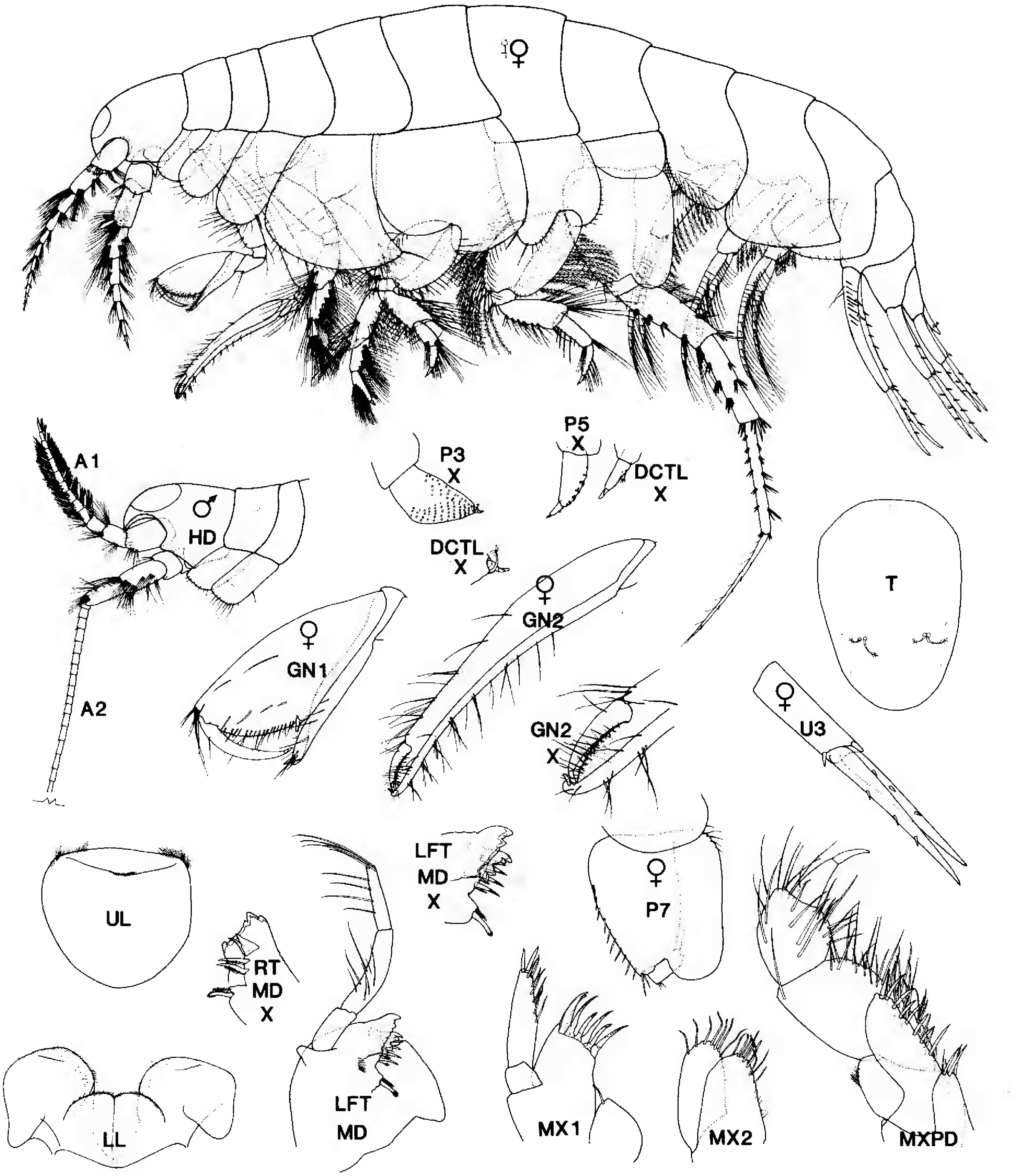

FIG. 38. Americhelidium millsi, new species. Neah Bay, Washington. Female (5.5 mm); male (4.2 mm).

half way point of stout palp segment 2.

Coxa 1, relatively narrow, hind corner broadly rounded, hind margin with 1-2 spines, lower margin weakly setose. Coxa 2, hind margin with single spine. Gnathopod 1, basis with strong antero-medial cluster of medium setae, and several long postero-median setae; propod slender, narrow proximally, palm nearly smooth regularly oblique; carpus narrow, hind lobe slender, apex with single spine, extending beyond palm. Gnathopod 2, basis very slender, hind margin with 1-2 long setae; propod very elongate, slender, antero-distally setose, length 7-8X maximum depth; dactyl small, length ~10% propod; carpus very narrow, posterior guarding lobe fused to but finely demarcated from propod throughout its length. and relatively strongly setose posteriorly.

Coxa 4 strongly broadened distally, hind corner acute, strongly produced. Peraeopods 3 & 4, distal segments very strongly setose; segment 6 very short, length little greater than depth, dactyl minute. Coxa 5 very broad, nearly as deep as coxa 4, distinctly postero-lobate, hind lobe weakly setose below. Coxa 6, antero-distal lobe strong, regularly rounded below. Peraeopods 5 & 6, bases subsimilar, 6 the larger; dactyls medium; basis of 6 very strongly plumose-setose anteriorly. Peraeopod 7, basis slightly narrowing to large deep postero-distal lobe; inner face with short antero-proximal setal row, and distal submarginal row of 5-6 long plumose setae.

Pleon side plate 2, hind corner acute, produced; plate 3, hind corner obtuse Uropod, rami extending beyond uropods 1 & 3, outer ramus the shorter. Uropod 3, rami subequal in length each with 3 marginal spines.

Telson relatively broad, narrowing to rounded apex, penicillate setae submedian.

Coxal gills and brood plates regular.

Male (3.5 mm) (diagnosis modified from Mills, 1962). Antenna 1, peduncular seg-ments 2 & 3 shorter than in female; basal flagellar segments not callynophorate, not bearing numerous aesthetascs. Antenna 2, peduncular segments 4 & 5 short, lacking anterior marginal brush setae; flagellum elongate, 40-45 seg-mented.

Mandibular palp segment 3, length 2/3 segment 2, inner margin with regular pectinate "D" setae.

Male (4.2 mm). Antenna 1, peduncular segments 2 & 3 shorter and less setose than in female; flagellum 10-segmented, callynophorate but not fused, margins thickly lines with aesthetascs. Antenna 2, flagellum elongate, 40+ segmented.

Mandibular palp segment 3 regular, posterior margin with pectinate "D" setae.

Etymology: The species is named in honour of Dr. Eric L. Mills, Dalhousie University, who pioneered the study of oedicerotid amphipods in the Canadian Pacific region.

Distributional Ecology. Known only from three locations on the south shore of the Strait of Juan de Fuca, in muddy sand, at LW level.

Taxonomic commentary. *Americhelidium millsi* is the most advanced and most specialized species of the genus, not closely related to any other, but least different from *A. shoemakeri* (Mills, 1962).

Americhelidium micropleon (J. L. Barnard)

Synchelidium micropleon J. L. Barnard, 1977: 877, figs. 1-4.—Barnard & Karaman, 1991: 566.

Diagnosis (after Barnard, 1977). Female (3.37 mm): Head, rostrum short; eyes consisting of weakly pigmented, loosely aggregated ommatidia. Antennae 1 & 2 subequal in length; flagella with 8-9 segments.

Mandible with unequally bispinose molar and 3-4 short stout blades; palp segment 3 very short, ~1/3 segment 2. Maxilliped, inner plate small, apical margin with 2 slender spines; palp segment 3 very stout, width > 2/3 length.

Gnathopod 1, propod relatively short and deep, palm nearly vertical. Gnathopod 2, propod very slender; line of fusion with carpus visible proximally and distally; lower margin weakly setose.

Coxa 4 much broader and deeper than coxa 3, hind process strongly produced. Coxa 5 very large, deep,distinctly postero-lobate. Peraeopods 3 & 4, segments 5 & 6 very short, stout, dactyls vestigial. Peraeopod 6 (especially basis) distinctly larger than peraeopod 5; dactyls very short. Peraeopod 7, basis broad, narrowing distally to deep posterior lobe; dactyl slender,tapering, length > segment 6.

Pleon plate 2, hind corner squarish. Uropods 1 & 2, outer ramus the shorter, rami extending well beyond rami of short uropod 3. Telson narrowing distally, apex rounded.

Male (2.39 mm). Antenna 1, flagellum with 5 slender aesthetascs on proximal 5-6 segments. Antenna 2, flagellum not elongate. Mature male may be non-pelagic.

Taxonomic and distributional commentary. This small species occurs only along open sandy beaches of the southern California coast. It exhibits generally apomorphic character states that typify the *pectinatus* subgroup within the genus *Americhelidium* (fig. 42, p. 142). Such apomorphies include the thick mandibular blades, short maxillipedal outer plate, elongate propod of gnathopod 2, posteriorly unproduced pleon plates 2 & 3, short uropod 3, and sharply rounded telson.

DISCUSSION AND CONCLUSIONS.

This study treats the systematics and distributional ecology of oedicerotid amphipods of the *Monoculodes* and *Synchelidium* supergroups in the North Pacific region. These encompass nearly 50 described species in 15 genera. The foregoing illustrated diagnoses have revealed morphological similarities between taxa that, as a result of numerical taxonomic analysis (below), are of probable phyletic significance.

For this purpose, the character states of genera and species are phyletically ordered and analyzed, using a modification of the UPGMA system of Sneath and Sokal, (1973) that employs an index of morphological similarity termed the Plesio-Apomorphic (P.-A.) Index. This modification has been utilized in previous development of natural relationships and classifications in other amphipod groups , e.g., in Conlan (1983); Jarrett & Bousfield (1994); Bousfield and Hendrycks (1995). The degree of primitive or advanced condition of the taxon is direction proportional to the magnitude of the P.- A. Index; taxa with low numbers are primitive, those with relatively higher numbers are advanced.

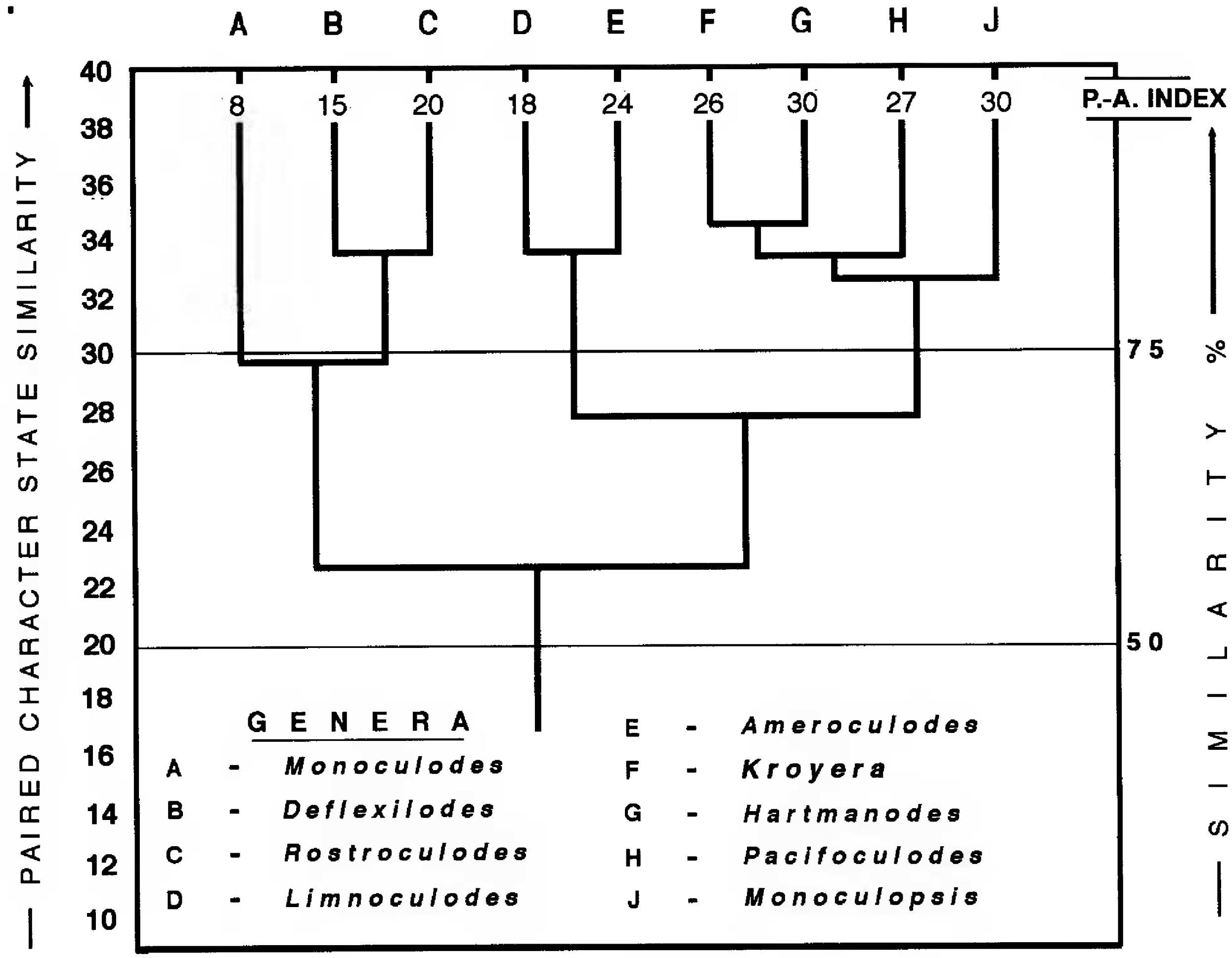

FIG. 39. PHENOGRAM: GENERA OF THE *MONOCULODES* GROUP.

Phenograms of taxonomic groups are developed from matrices of 16-20 characters and corresponding character state extremes. A phenogram of morphical similarities for genera of the *Moncolulodes* group is provided in Figure 39, based on the characters states of Table I. Similarly, phenograms for species of North Pacific species of *Monoculodes* Stimpson (sens. str.), *Pacifoculodes*, new genus, and species of the *Americhelidium* group, are provided in figs. 40-42, respectively. Tabular data, on which the latter phenograms were based, are considered overly bulky and repetitive for publication here, but can be supplied on request.

Of the 9 monoculodid genera analyzed in Fig. 39, some (e.g., *Monoculodes, Deflexilodes*) are speciose, with broad distribution elsewhere in the northern hemisphere. Others (*Monoculopsis, Limnoculodes, Hartmanodes, Rostroculodes*) are virtually monotypic and/or have very narrowly limited regional distributions. In Fig. 39, three basic subgroups within the *Monoculodes* complex cluster at at or above the 75% similarity level, viz.:

(1) a *Monoculodes-Deflexilodes, Rostroculodes* subgroup with P.-A. indices of 8 - 20 and having generally plesiomorphic characters states (Fig. 1, p. 79, and Table I). Component species tend to be sublittoral to bathyal, and best represented in the colder arctic and northern oceans (Table II, below).

(2) a *Limnoculodes-Ameroculodes* subgroup, having intermediate character states (Fig. 1) and intermediate P.- A. values of 18-24. Member species tend to occupy shallow, littoral and estuarine habitats along warm-temperate shores of eastern Asia and eastern North America (Table II).

(3) a *Pacifoculodes* subgroup having generally advanced character states (Fig. 1) and relatively high P. - A. values of 27-30. The group encompasses the small, warm temperate-tropical genus *Hartmanodes*, and the monotypic, amphiboreal genus *Kroyera*, on the one hand, and the nearly monotypic, high arctic genus *Monoculopsis* on the other. The latter vies with advanced members of *Pacifoculodes* (e.g., *A. millsi*) in exhibiting the most apomorphic features of mouthparts and appendages, especially the peraeopods, and gnathopods. Thus, the degree of fusion of the carpal lobe and the elongation and distal narrowing of the propod approaches the condition in more primitive members of the *Synchelidium* complex (e.g., *Hongkongvena*, below). Evolutionary thrust in this group is apparently towards utilizing food resources of high energy substrata of shallow sandy shores, where powerful, strongly setose limb segments would not only assist in burrowing within rapidly shifting substrata, but would

TABLE I. CHARACTERS AND CHARACTER STATES OF THE *MONOCULODES* COMPLEX .

CHARACTER*	CHARACTER STATE VALUE		
	Plesiomorphic **0**	**Intermediate** **1**	**Advanced** **2**
1. Rostrum, form	straight	Apically deflexed	Elongate, eye distal
2. Antenna 1 peduncular segment 2, length rel. to pedunc. segment 1	shorter	subequal	longer
3. Mandibular palp segment 3, length relative to segment 2	subequal	shorter	much shorter
4. MX1, number outer plate spines	9	8	7
5. MXPD, width of palp segment 2	narrow	medium	broad
6. *Gnathopod 1, carpus, length of anterior margin	elongate	medium	narrow
7. *Gnathopod 1, carpus, length of posterior lobe	small, 1/2 propod hind margin	medium	large reaching palmar angle
8. *Gnathopod 1, propod shape	short, deep	medium	elongate
9. *Gnathopod 2, carpus, length of anterior margin	elongate (> depth)	medium	narrow
10.*Gnathopod 2, carpus, length of posterior lobe	short, < 1/2 propod	medium	elongate, exceeding posterior palmar angle
11. *Gnathopod 2, propod shape	short, deep	medium (L>W)	elongate, tapering
12. Coxa 4, breadth	narrow, deeper than wide	width = depth	broad , much wider than deep
13. *Peraeopods 3 & 4, length of segment 5 rel. to segment 6	5 >6	segments subequal	short; seg 5<6
14. *Peraeopods 3 & 4, length of dactyls	elongate >segment 6	medium	short, <1/2 segment 6
15. Peraeopods 5 & 6, length of segment 5/ segment 6	segment 5>>6	segments subequal	short, segment 5 < 6
16. Peraeopods 5 & 6, length os dactyls	elongate, >segment 6	medium	short, segment 5 < 6
17. *Peraeopod 7, basis, size of posterior (lower) lobe	small or lacking	medium	large, exteding below segment 3 (ischium)
18. Pleon plate 2, hind corner	acute, produced	squared	obtuse, rounded
19. Uropods 1 & 2, rami	subequal	outer ramus slightly the shorter	outer ramus distinctly the shorter
20. Telson, apical margin	notched	straight	rounded

* Character states illustrated in Fig. 1, p. 79

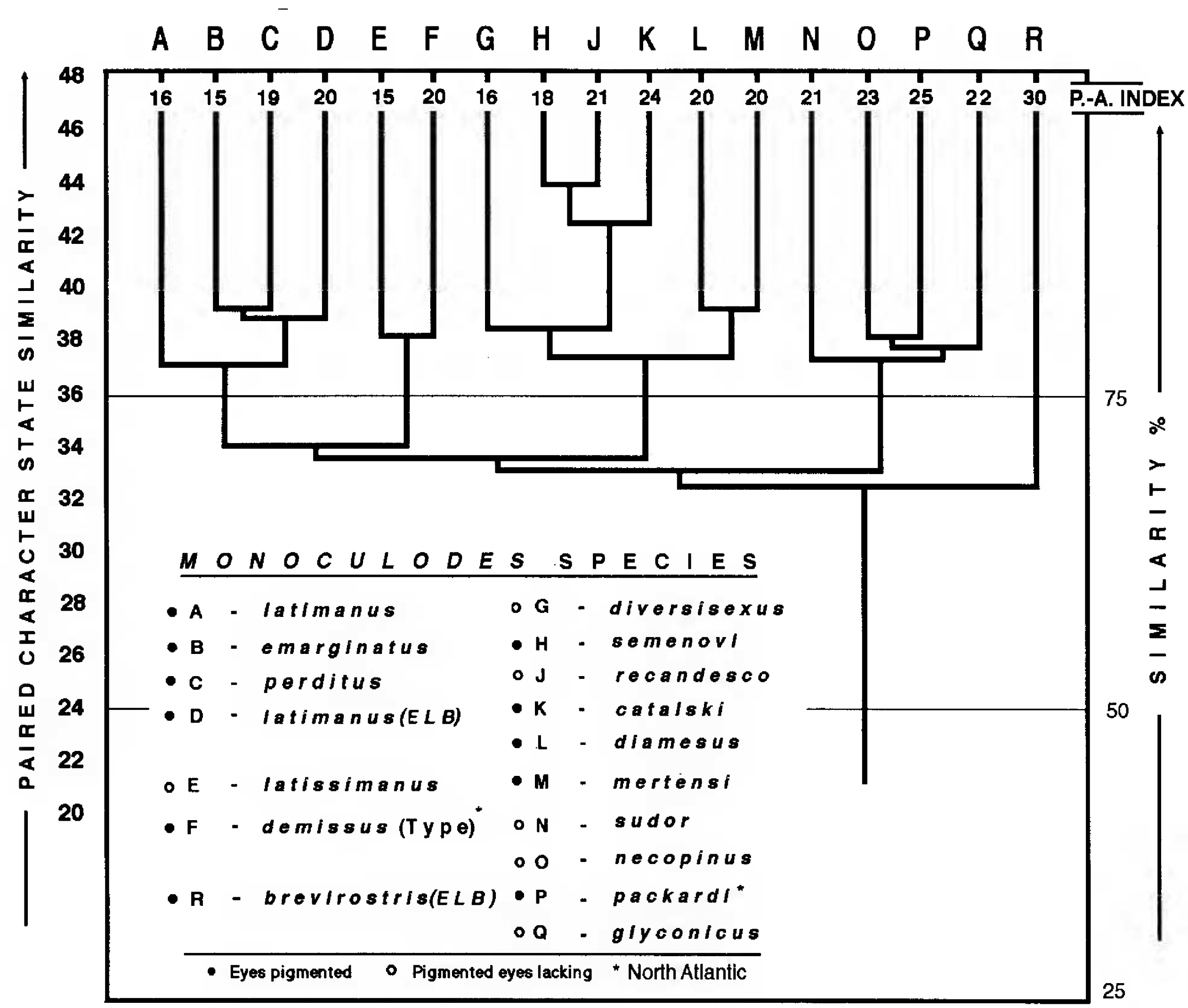

FIG. 40. PHENOGRAM: NORTH PACIFIC SPECIES OF *MONOCULODES.*

presumably help maintain the integrity of the ventral repiratory passage, despite pressure from infiltrating fine sediments (see Enequist, 1949).

The 15 species of *Monoculodes* Stimpson (sens. str.) recorded to date from the North Pacific region are all sublittoral (mostly eyed) and bathyal (eyeless). The phenogram (Fig. 40) is based on characters and character states similar to those of Fig. 39.

The species cluster into 5 major groups at about the 70% similarity level, viz.:

(1) A primitive, sublittoral, mostly North American *latimanus-emarginatus* subgroup of 3 species. These mainly eyed species display basic plesiomorphic characters states, especially of the gnathopods, and have relative low P. - A. values of 16-20.

(2) A bathyal *M. latissimanus* subgroup, widespread in holarctic seas, that bears closest similarity to the sublittoral generic type species, *M. demissus* of the boreal-subarctic North American Atlantic region.

(3) A slightly more advanced *semenovi -recandesco* subgroup of six ,mostly eyed,sublittoral and bathyal species, that occur on both coasts, and show intermediate P.-A. values of 18 - 24. The species are characterized by a short rostrum and broad anterior head lobe.

(4) An advanced *necopinus* subgroup of three eyeless, bathyal North American Pacific species, with greater than 75% similarity to the eyed sublittoral North Atlantic species, *M. packardi* Boeck. These exhibit relatively advanced features of the gnathopods and show relatively high P.- A. values of 21-25.

(5) A monotypic, North American endemic *brevirostris* subgroup that is least different from the short-rostrate, second subgroup of species (especially *M. catalskii*). It shows mainly advanced character states (high P.A. index of 30), including an elongate antenna 1 and well-developed fossorial peraeopods.

Of these 15 species, 13 are regionally endemic and only two (*M. latimanus* and *M. latissimanus*) have been recorded

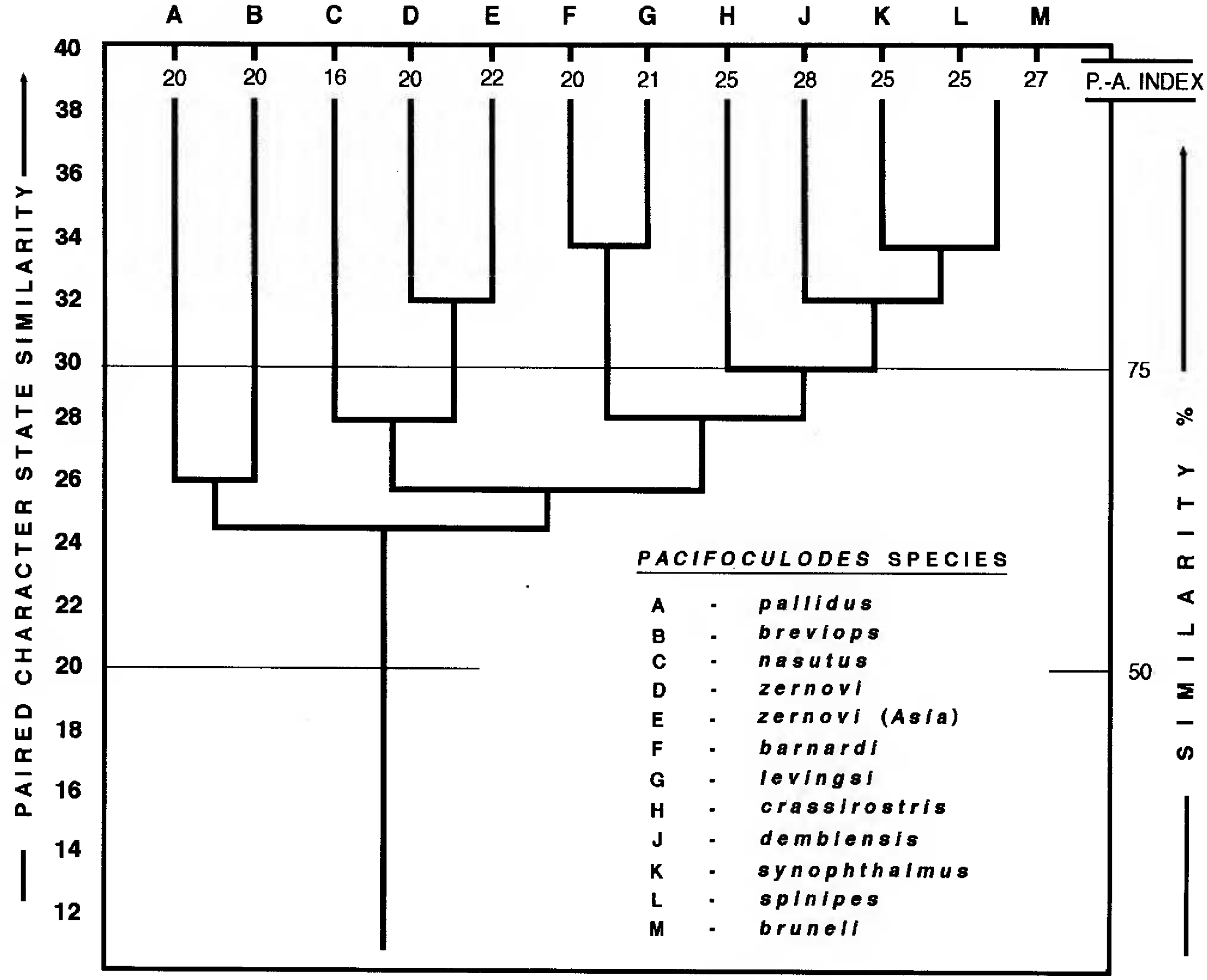

FIG. 41. PHENOGRAM: SPECIES OF *PACIFOCULODES*, NEW GENUS.

elsewhere. High regional endemicity is not unexpected in fossorial species, especially cold-temperate stenothermals, that may be limited to the north and south by polar and subtropical temperate extremes respectively.

The North Pacific is home to all 12 described species of *Pacifoculodes*. The phenogram (Fig. 41) is based on character states similar to those of Table I, the data base for which is available on request.

The species cluster into three main groups at or above the 60% similarity level, viz.:

(1) A *pallidus-breviops* subgroup of relatively small, primitive forms confined to the northwestern Pacific region. These exhibit mainly plesiomorphic character states, especially of the gnathopods, and show a low P.- A. value of 20.

(2) A *zernovi-nasutus* subgroup of three relatively primitive species having P.- A. indices of 16-22. They have relatively long, straight rostrums and shallow basal lobes on peraeopod 7. *P. zernovi* is the only pan-Pacific member of the genus.

(3) A more advanced *barnardi-spinipes* subgroup that shows P.-A. values of 21-28. The animals are relatively large, with powerfully developed fossorial appendages. This cluster subdivides at the 75% similarity level into two further groups. Thus, a a relatively primitive *barnardi-levingsi* subgroup is endemic to subtidal coastal habitats of the North American coast. A more advanced and more northerly, mainly shallow-subtidal subgroup contains 4 species, two of which (*P. dembiensis* and *P. synophthalmus*) are Asiatic-Pacific, and the two closely related (sibling) species *(P. spinipes* and *P. bruneli)* are North American endemic.

The previous record of the European-Atlantic species, *P. crassirostris* from the Sea of Japan (Gurjanova, 1951), has been demonstrated by Ledoyer (1972) to be almost certainly that of a different, unnamed species. Similarly, the record of *P. pallidus* from the Sea of Japan (Gurjanova, 1951) has not yet been confirmed, and may also prove to be a further undescribed species of the genus. In any event, both

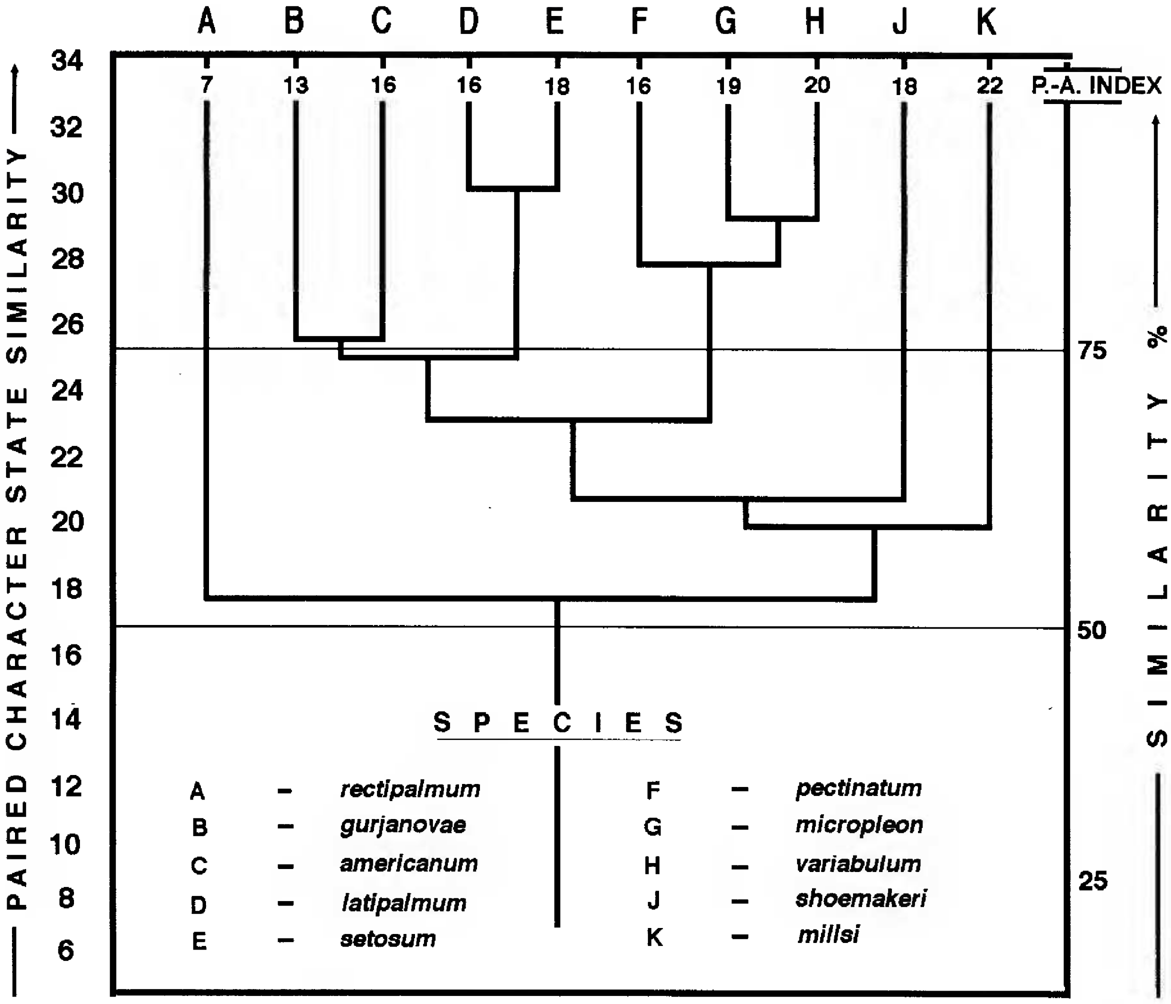

FIG. 42. PHENOGRAM: SPECIES OF *AMERICHELIDIUM.*

crassirostris and *pallidus*, as described and figured by Sars (1895), conform most closely with the character states of the genus *Pacifoculodes.*

A phenogram of the 10 described species of *Americhelidum* (Fig. 42) is based on slightly fewer and different characters and character states than listed in Table I; some have been diagnosed in generic treatments peculiar to the *Synchelidium* complex (above).

In the present analysis, five subgroups cluster at or better than the 60% similarity level, viz.:

(1) A monotypic *rectipalmum* subgroup that shows very plesiomorphic character states and a low P.- A. index of 7. This North American Pacific endemic is remote from all other species at about the 50% level, and might justify separate subgeneric, if not full generic recognition.

(2) A *setosum* subgroup, of relatively primitive species, clusters at or above the 75% similarity level, and shows intermediate P.-A.values of 3 -18. Despite their close internal clustering, the subgroup is surprisingly disparate biogeographically. Thus, it encompasses 2 Asiatic-Pacific endemics, a North American-Pacific endemic, and the single known American-Atlantic species, *A. americanum.*

(3) A relatively advanced *micropleon* subgroup (P.- A. values of 16-20) of closely similar species. They cluster at and 80-85% similarity and show high P.- A. values of 19-20. All members are North American endemic.

(4) A monotypic *shoemakeri* subgroup consisting of a single species that is morphologically variable throughout its broad North American range. It shows a medium P.- A. value of 18, but is isolated from the other groups at the 60% similarity level. Further study may reveal this "super" species to be a complex of closely related (sibling) species, much as Mills (1967) discovered during his careful investigations on *"Ampelisca spinipes"* on the North American Atlantic coast.

(5). A *millsi* subgroup, containing the single most advanced and specialized species, shows a high P. -A. Index of 22. This distinctive taxon is isolated from the other four subgroups at the 60% similarity level. The species is a North American Pacific endemic, with a restricted local range (p. 145). Its specialized, even unique, morphological features suggest that it may be adapted to burrowing in fine silty sands, at and below tide levels, possibly under reduced levels of free oxygen but relatively high levels of reduction gases.

TABLE II. DISTRIBUTION OF SPECIES OF *MONOCULODES* SENS. LAT. IN NORTH PACIFIC*

TAXON	BIOGEOGRAPHIC ZONES								
	1	2	3	4	5	6	7	8	9
I. *Monoculodes* Stimpson									
packardi Boeck	X	x							
semenovi Gurjanova	X	?							
latimanus Boeck	X	X	X	X	X	X			
mertensi Gurjanova		?	X						
castalski Gurjanova		X	X						
diamesus Gurjanova		X			?	X			
perditus Barnard				?	X	X		x?	X
brevirostris n. sp.					?	X			
latissimanus Stephens							X	X	X
recandesco Barnard							X		X
emarginatus Barnard							X	X	X
sudor Barnard									X
necopinus Barnard								?	X
glyconicus Barnard								?	X
diversisexus Barnard									X
II. *Deflexilodes* n. g.									
uncinatus (Bulycheva)	X	?							
similis n. sp.			X	?	X	X			
enigmaticus n. sp.				X	X	X			
tuberculatus Boeck				X					X
norvegicus (Boeck)									X
III. *Kroyera* Bate									
carinata Bate	X								
IV. *Monoculopsis* Sars									
longicornis (Boeck)		?	X						
V. *Pacifoculodes* n. g.									
pallidus (Sars)	X								
synophthalmus (Bul.)	X	?							
nasutus (Bulycheva)	X	?							
breviops (Bulycheva)	X	?							
dembiensis (Bul.)	X	X							
crassirostris (Hansen)?	X	X	X						
zernovi (Gurjanova)	X	X	X	X	X	X			
bruneli n. sp.			x?	X					
levingsi n. sp.					X				
spinipes (Mills)					X	X	X	?	
VI. *Hartmanodes* n. g.									
murrius (Barnard)									X
hartmanae (Barnard)								X	X
nyei (Shoemaker)									X

BIOGEOGRAPHIC ZONES: 1. Sea of Japan; 2. Sea of Okhotsk; 3. Bering Sea & Aleutians; Southeastern Alaska; 5. Northern B. C.; 6. Southern B. C.; 7. Washington-Oregon; 8. Northern California; 9. So. & Baja California.

*exclusive of *M. dentimanus* Jo, 1990, *M. muwoni* Jo, 1990, and *M. koreanus* Jo, 1990.

TABLE III. DISTRIBUTION OF THE*SYNCHELIDIUM* COMPLEX IN THE NORTH PACIFIC.

TAXON	BIOGEOGRAPHIC ZONES								
	1	2	3	4	5	6	7	8	9
1. ***Perioculodes*** Sars									
longimanus (B.&W.)	X								
longirostratus Hiray	X								
pinguis Hirayama	X								
2. ***Pontocrates*** Boeck									
altamarinus (B.&W.)	X								
arenarius (Bate)	X								
3. ***Hongkongvena*** Hiray									
memorabilis Hiray.	X								
4. ***Sinoediceros*** Shen									
homopalmatus Shen	X								
5. ***Eochelidium*** n. g.									
bulytschevae (K.&T.)	X								
carinorostrum (Jo)	X								
rostriopiculum (Hir.)	X								
lenorostralum (Hir.)	X								
nonrostrum (Hir.)	X								
nonmiraculum (Hir.)	X								
miraculum (Imbach)	X								
6. ***Chitinomandibulum***									
emargicoxa Jo	X								
ampliforbicum (Hir.)	X								
7. ***Finoculodes*** Barnard									
omnifera Barnard							X		
8. ***Americhelidium*** n. g.									
latipalpum (Hiray.)	X								
gurjanovae (K. & T.)	X								
rectipalmum (Mills)			x	X	X	X	X	x?	
setosum n. sp.				X	X				
variabilum n. sp.					X	X	X		
millsi n. sp.						x?	X		
pectinatum, n. sp.						X	X	X	
shoemakeri (Mills)			x	X	X	X	X		
micropleon (Barnard)								x	X

BIOGEOGRAPHIC ZONES

1. Sea of Japan; 2. Sea of Okhotsk; 3. Bering Sea & Aleutians; Solutheastern Alaska; 5. Northern B. C.; 6. Southern B. C.; 7. Washington-Oregon; 8. Northern California; 9. Southern & Baja California.

Biogeographic Analyses:

Table II. outlines the distribution of the 6 genera and 37 North Pacific species within the *Monoculodes* complex. North Pacific records of *Kroyera carinata* Bate, though doubtful, are included here. These totals represent more than two-thirds of the entire world monoculodid fauna. Only the polar regionally endemic genus *Rostroculodes* (6 species), and the North American Atlantic genus *Ameroculodes* (2+ species) are apparently absent from the North Pacific proper.

Within the North Pacific monoculodid fauna, all six genera and 29 of the species have been recorded from North American coastal waters whereas only 5 genera and 16 species are known from the western North Pacific. Only 7 species in 4 genera occur along both coasts, almost all in the Bering Sea region. The western region contains only one described species of the primitive, mainly North Atlantic genus *Deflexilodes,* and none of the relatively advanced neotropical genus *Hartmanodes.* However, the western region is dominated by the advanced, largely intertidal and shallow water genus *Pacifoculodes* , with 7 species, whereas the the North American region has only 4 species.

In further contrast, the eastern North Pacific also has a higher percentage of the primitive subtidal and bathyal genus *Monoculodes* (13 species vs. 6 species), as well as four mainly subtidal species of the primitive genus *Deflexilodes.* The three shallow-water species of *Hartmanodes,* of southern and Baja California (zone 9), find no counterpart in the western Pacific, unless these be members of the *Synchelidium* generic complex (below).

Table III outlines the distribution of the 8 genera and 26 described North Pacific species within the *Synchelidium* complex. As noted above, these numbers represent a very high percentage of the total world fauna known to date. Except for the 5 members of the genus *Synchelidium,* and one of *Americhelidum* from the western North Atlantic, the group is known elsewhere only in the eastern North Atlantic and Mediterranean region (e.g, species of *Perioculodes*).

The western North Pacific has the greatest diversity of synchelidiid genera and species. Five of its seven genera, and nearly all of its 18 species are regionally endemic. Two of these genera (*Perioculodes* and *Pontocrates*) are recorded elsewhere, mainly from the eastern North Atlantic. By contrast, the eastern North Pacific is home to only two genera and 8 species, only one genus of which (*Finoculodes*) is endemic. However, the advanced genus *Americhelidium* is dominant on the North American coast, but barely represented on the Asiatic coast.

On the Asiatic coast, all species and genera of the *Synchelidium* complex are limited distributionally in the northern Sea of Japan. On the North American Pacific coast, varieties of the most primitive species of *Americhelidum*, *A. rectipalmum* (Mills), extend northward to the Bering Sea region. This species also has the deepest bathymetrical range within the genus, suggesting a cold-adapted physiology. By contrast, one of the most advanced species morphologically, *A. micropleon,* also has the most southerly range and is strictly intertidal and shallow water in bathymetrical range.

Analysis of the genus *Americhelidium,* in which both primitive and advanced members are regionally endemic, suggests strongly that the North Pacific is a centre of origin and evolution of the entire group. The fact that the most advanced members are intertidal, shallow water, and to some extent estuarine, and only very few, especially primitive members, are subtidal and bathyal (e.g. *Finoculodes)* strongly suggests that the group has only recently evolved, possibly since the beginning of the Tertiary Era and is now actively in process of speciation. The more advanced members are intertidal and shallow water, perhaps in the process of replacing the primitive members of the group that are now confined to deeper water. Such "evolutionary bathymetry" contrasts strongly with that previously found in more primitive fossorial amphipod superfamily groups of the North Pacific (e.g., Phoxocephaloidea) wherein the more primitive members are intertidal, and the advanced members subtidal (Jarrett & Bousfield, 1994).

The high degree of variability observed throughout the range of North American Pacific species, would tend to support such speculation. Thus, eastern and western shores of the North Pacific share some genera and a few species, but overall, these two regions exhibit a remarkable and somewhat puzzlingly difference of oedicerotid faunas. North American shores exhibit a far richer assemblage of primitive monoculodids whereas Asiatic Pacific waters support a broad spectrum of the advanced synchelidids, at both genus and species levels. Perhaps paradoxically, the most advanced monoculodid genus, *Pacifoculodes,* is more diverse in the western Pacific, but the most advanced synchelidid genus, *Americhelidum,* is richer in species along North American shores. Further study of life style and reproductive behaviour may help solve this apparent conundrum.

LEGEND FOR FIGURES

A1 - antenna 1
A2 - antenna 2
CX - coxa
DCTL - dactyl
DORS - dorsal
EP1-3 - epimeral plates 1-
GN1 - gnathopod 1
GN2 - gnathopod 2
HD - head

I. P. - inner plate
LL - lower lip
LFT - left
MD - mandible
MX - maxilla
MXPD - maxilliped
O. P. - outer plate
P1-7 - peraeopods 1-7
PEN - penultimate

PLP - palp
PLEON - pleon
RT - right
T - telson
U1-3 - uropods 1-3
UL - upper lip
UROS - urosome
T - telson
X - enlarged

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